AFFORDABILITY ANALYSIS

"Affordability Analysis Capability: Determining a Relevant / Common Set of Candidate Measures" Workshop

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Workshop Background & Objectives

- **Background**
  - o DoD customer requires affordability analysis
  - o A government / industry community of practice has developed an affordability analysis process
- **Objectives**
  - o Present overviews on the customer requirement and the affordability analysis process
  - o Review the PSM measurement process
  - o Develop a measurement taxonomy and process to be incorporated in the affordability analysis process

Workshop Approach

- **Introduction / Background Brief**
  - Present overviews on the customer requirement and the affordability analysis process
  - Review the PSM measurement process
  - Introduce the breakout sessions
- **Breakout Sessions**
  - Present an overview of an affordability analysis activity
  - Conduct a facilitated discussion to use the PSM measurement process to develop an affordability analysis measurement process
- **After the Workshop**
  - Use the workshop raw data to develop products (i.e., white paper, result briefs, measurement taxonomy, a measurement development process, and an update to the affordability analysis process)

Introduction / Background

- **Customer Requirement**
- **Affordability Analysis Background**
  - o History of Affordability Analysis
    - Government, Industry & Academia Community of Practice
  - o What is Affordability Analysis?
  - o Affordability Perception & Key Definitions
  - o MORS "Big A" Affordability Analysis Process Guide
- **Breakout Sessions Introduction**
  - o Terminology
  - o Affordability Analysis Activity # 1, Requirements & Needs, Overview
  - o Measurement Development Review
  - o Goals, Outputs & Products

DoD and Non-DoD

- The DoD has largely influenced this work to date.
- The affordability analysis process was developed by a government, industry, and academia team (MORS Affordability Analysis Community of Practice).
- There are a lot of DoD terms used in this brief.
- The intent moving forward is to provide guidance suitable for leveraging by civilian government departments and agencies as well as commercial efforts.

DoD's MOST CHALLENGING GOALS

Voice of the Customer

2009 Weapons Systems Acquisition Reform Act (WSARA) & Better Buying Power (BBP) Memos

Primary Focus

Work Together Upfront to Effectively Refine Realistic Expectations & Goals

- ✓ *Performance … Requirements*
- ✓ *Schedule … Key Events (IOC)*
- ✓ *Costs … Affordability Metrics*

for Acquisition Program Baseline (APB) at MS 'B' & Future Win-Win Increments!

Robert M. Gates
Secretary of Defense
[Nov 2006 – Jun 2011]

Ashton B. Carter
Deputy Secretary of Defense

Focus: 'Best Value' = Affordable Solutions with Low Risks … Realistic Program Plans, Schedules & Costs!

Customer Motivation & Relevance - Affordability

DoD 5000.2, DAG
and CJCSI 3010.02d
Define Affordability

JCSI 3170.01I
Defines Affordability &
Mandatory KPPs / KSAs

Life Cycle Management Framework

- Readiness or Performance Driven Outcomes Throughout the Life Cycle
- Align Resources to Readiness
- Track Life Cycle Performance

Investment Set Cost Profile
Within Total Obligation Authority limits
Of Portfolio and Enterprise

Key Performance Parameters (KPPs)
System Survivability, Force Protection,
Material Availability, Operational Availability,
And Net-Ready

Key System Attributes (KSAs)
Reliability and Operations & Support Cost

Services / Programs
To Implement

Our Customer requires us to *BALANCE PERFORMANCE* and the *COST* of achieving it.

2016 National Defense Appropriations Act

- **U.S. Code Title 10, Chapter 139, 25 November 2015**
  - Section 2366a – Major defense acquisition programs: determination required before Milestone A approval

    the Secretary of the military department concerned and the Chief of the armed force concerned ***concur in the cost, schedule, technical feasibility, and performance trade-offs*** *that have been made with regard to the program*

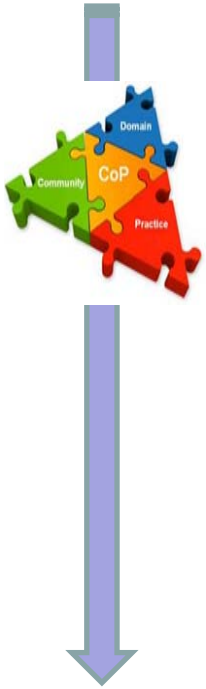
  - Section 2366b – Major defense acquisition programs: determination required before Milestone B approval

    the Secretary of the military department concerned and the Chief of the armed force concerned concur among ***cost, schedule, technical feasibility, and performance tradeoffs have been made to ensure that the program is affordable***

MORS and Affordability Analysis

2012

In response to those demands, in October of 2012 MORS held a follow-on workshop, ***"Affordability Analysis: How Do We Do It?"*** Participants defined differences in methods for affordability analysis and cost analysis, and the workshop confirmed that ***the topic is sufficiently complex and important to demand more regular attention.*** Leaders in DoD again asked MORS for help.



- **STEP 1, Feb 2013: Formed Affordability Analysis Community of Practice (AA CoP) – includes government, industry, and academia**
- **STEP 2, Dec 2013: Created MORS "Affordability Research Document (ARD)"**
  - MORS AA CoP organized research and leadership answers into one document
- **STEP 3, Mar 2015: Develop an Affordability Analysis "How To" Process**
  - Built on AA CoP "ARD" as a foundation
  - March 2014: Combined Lean Six Sigma Value Stream Mapping Event / MORS Workshop
  - MORS *"Big A" Affordability Analysis Process Guide*, Revision 8B, ready for pilots
- **STEP 4, 2015-2016: Commence Tests with Pilot Projects**
  - Government & Industry planning on 2-3 pilots

What is Affordability Analysis?

The Basics of Affordability Analysis are not Difficult

Things You Need to Know to Buy a House

- ✓ Need for house
- ✓ Fraction of budget available for house purchase
- ✓ Payment terms
- ✓ Willingness to give up other spending

Things You Need to Know for Affordability Decisions

- ✓ Needs and Priorities
- ✓ Fraction of budget available for need(s)
- ✓ Basis of Payment (Cost)
- ✓ Overall capability implications

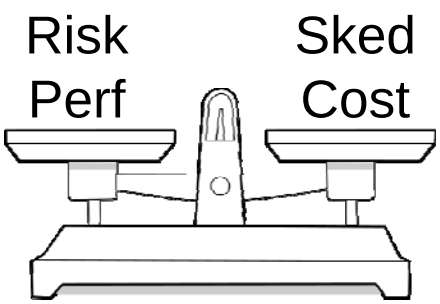
DoDI 5000.02, Encl 8 Comparison

- Affordability analysis and affordability constraints ***are not synonymous*** with cost estimation and approaches for reducing costs
- Cost estimates are ***generated in a bottom-up*** or parametric manner and provide a forecast of what a product will cost for budgeting purposes.
  - NOTE: Current wording omits analogy, expert opinion, and extrapolation that are also recognized cost estimating methods.
- Affordability constraints are ***determined in a top-down manner***

- DoDI 5000.02 Enclosure 8 concentrates on the cost variable first.
  - The difference between the affordability constraints and the cost estimates indicates whether actions must be taken to ***further reduce cost*** in order to remain within affordability constraints.
  - Independent of affordability constraints or cost estimates, program managers should always be looking for ways ***to control or reduce cost***.
  - When approved affordability constraints cannot be met—even with ***aggressive cost control and reduction approaches***—then technical requirements, schedule, and required quantities must be revisited

Current Definitions: Affordability

- **Affordability**
  - o The degree to which the resources being allocated to a capability relative to other uses of those resources reflects (i) the importance, urgency, and satisfaction of mission, strategic investment, and organizational needs, and (ii) a ***prudent balance of performance, cost, and schedule constraints consistent with the time phased availability (technical, market, and fiscal) of budgeted resources***.
- **Affordability Analysis**
  - o A process and assessment that supports resource allocation decision-making. It identifies and quantifies the performance expectations of stakeholders, assigns value to those expectations, and measures the life cycle cost of alternatives relative to both opportunity costs and resourcing actions or plans. Affordability analysis is ***balancing cost, performance, schedule, and risks while meeting missions.***



Affordability Interpretations

- **Affordability in the Large**
  - Assessing whether a mission, task, function, capability, system of systems, program, or initiative – considering what it is going to cost (or is costing us, i.e., the total costs) – provides sufficient value in the context of all of the other things needed ("**Big A**").
  - The Strategic View – Identifying the portfolio of solution(s) at the top level, considering life cycle cost and capability/performance in relation to the value provided by other things that are needed
- **Affordability in the Small**
  - Being frugal – being cost efficient in executing a program, from beginning to end and not being extravagant in choosing capabilities and solutions to challenges; getting the most bang for the buck ("**little a**").
  - The Tactical View – Minimizing costs while maximizing capabilities/performance.

Affordability Analysis Framework

Activity # 1 – Review Requirements, Needs & Desired Outcomes

- What is the mission and outcome I am trying to impact?
- What are the desired outcomes? How will I know they are achieved?
- Which capability's resource decisions will affect this desired outcome?

Is it needed? Are Requirements Properly assessed?

How much do we prefer this capability?

START

Activity # 2 – Assess Baseline and Gaps

- At what level do I resource this capability area? What areas of performance are going well? What is killing my budget?
- What are the most critical capability gaps to close or efficiencies to realize?

How much do we need it?

How much do we spend on related capabilities?

Is productivity and innovation incentivized?

Activity # 3 – Determine Feasible Alternatives

- What are choice approaches or courses of action (COA) needed to make needed changes? (Strategic, modernization, process, etc.)
- What are the alternatives to consider for each COA?
- How well does each perform? What is the risk? What is the 30-yr cost profile?

Is it a good deal we cannot pass up and why?

Are competitive methods used?

Activity # 4 – Evaluate Trade-Off Analysis

- How do these COA compare in net value to other elements in the portfolio?
- Do decision-makers at other levels need to be contacted?
- What is the best-value mix of investments in this portfolio?
- Are we "better off" than our prior portfolio? Within affordability boundaries?

Are BBP 2.0 / 3.0 initiatives leveraged? Is it worth the cost?

What are show stoppers we must attend to for success?

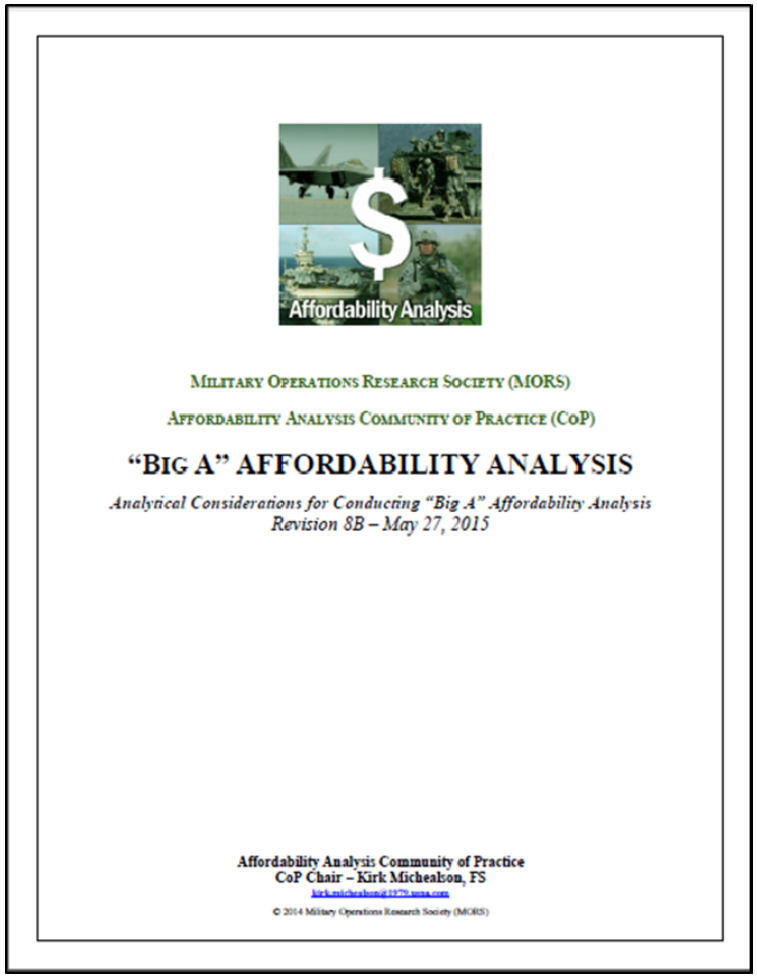
Affordability Exit Criteria: Sufficiency

- **Sufficiency Criteria to Support a Good Affordability Analysis**
  - o Grounded in a value proposition
  - o Addresses the entire life cycle
  - o Includes portfolio assessment
  - o Is time specific
  - o Contains data-driven analysis

Affordability Exit Criteria: Quality

- **If these sufficiency criteria are satisfied, the analysis will be able to provide a core set of quality information to decision makers**
  - o Prioritization — **How much do we prefer this capability?**
  - o Trade Demands — **How much do we need it?**
  - o Dollars per Capability — **How much do we spend on related capabilities?**
  - o Is it Worth the Cost — **Is it a good deal we cannot pass up and why?**
  - o Behavioral Change — **What are show-stoppers we must attend to for success?**

"Big A" Affordability Analysis Main Body



MILITARY OPERATIONS RESEARCH SOCIETY (MORS)

AFFORDABILITY ANALYSIS COMMUNITY OF PRACTICE (CoP)

"BIG A" AFFORDABILITY ANALYSIS

Analytical Considerations for Conducting "Big A" Affordability Analysis
Revision 8B – May 27, 2015

Affordability Analysis Community of Practice
CoP Chair – Kirk Michealson, FS

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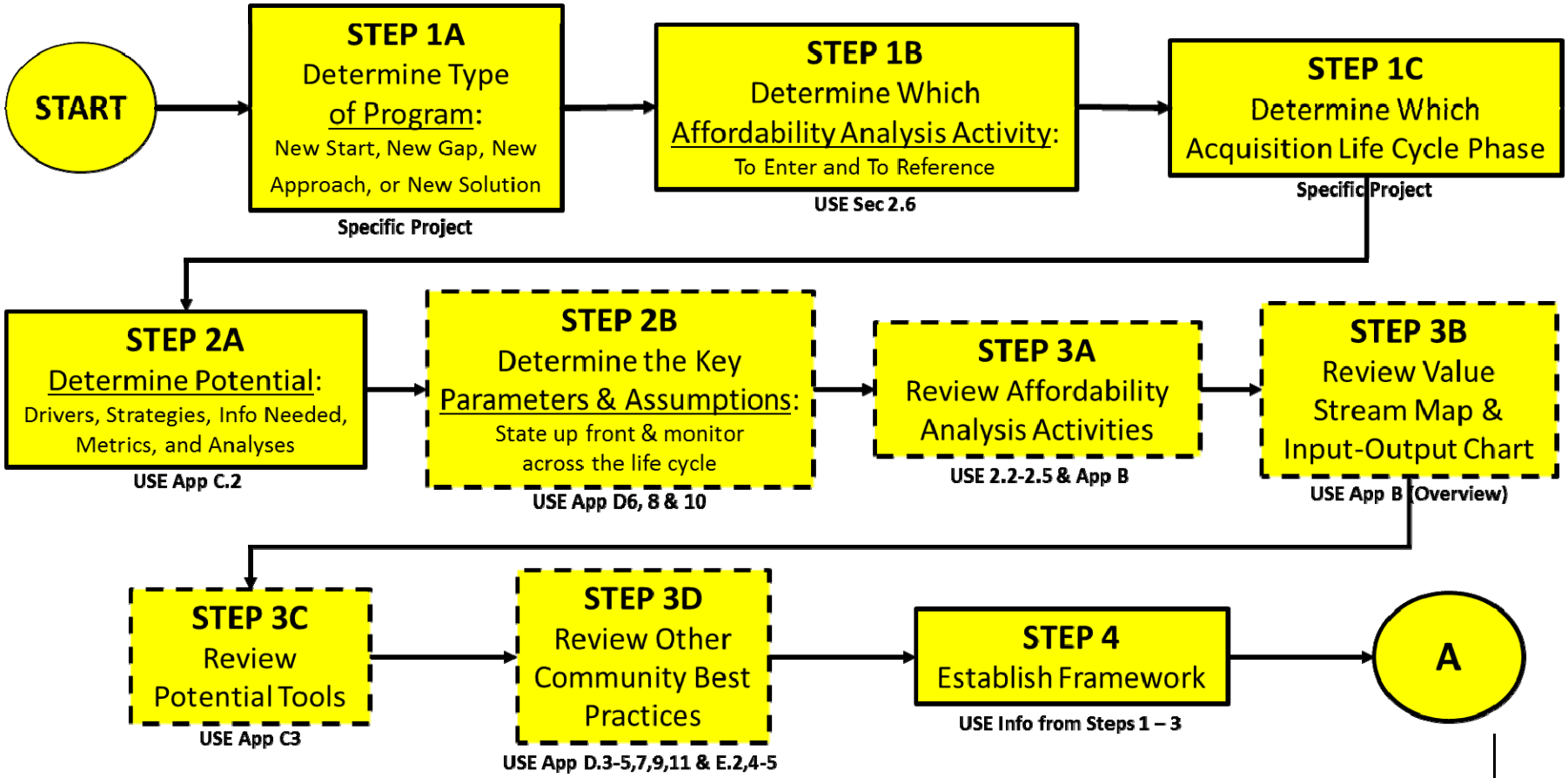
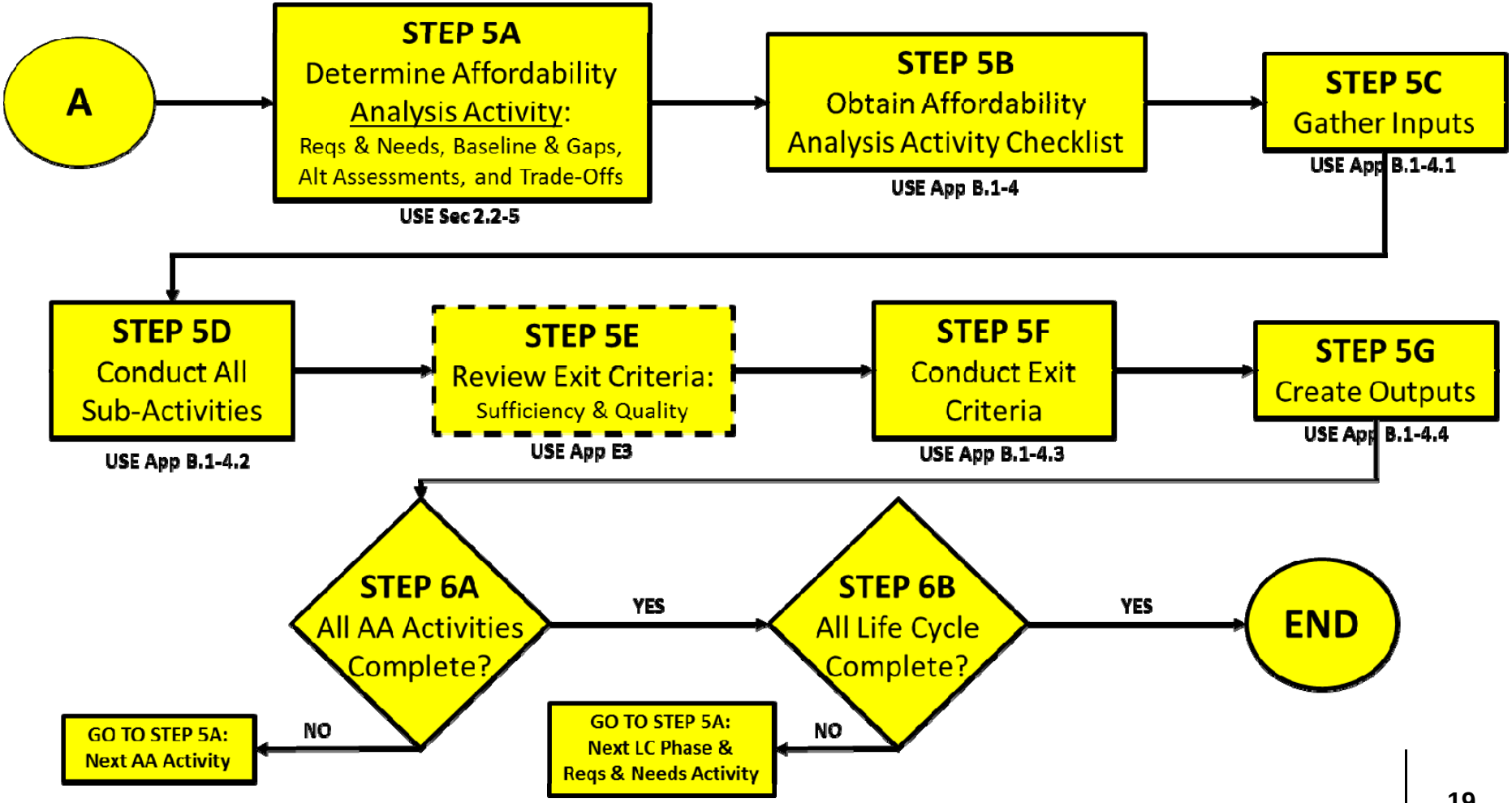
- **Executive Summary**
- **Sec 1: Background & Introduction**
  - o Affordability Challenges
  - o Affordability Definitions
  - o Purpose
  - o Value Proposition
- **Sec 2: Affordability Analysis Activities**
  - o Process Overview
  - o AAA # 1: Review Requirements & Needs Activity
  - o AAA # 2: Assess Baseline & Gaps Activity
  - o AAA # 3: Determine Feasible Alternatives Activity
  - o AAA # 4: Evaluate Trade-Off Analysis Activity
  - o Affordability Analysis Activities across the Acquisition Life Cycle

Affordability Preparations

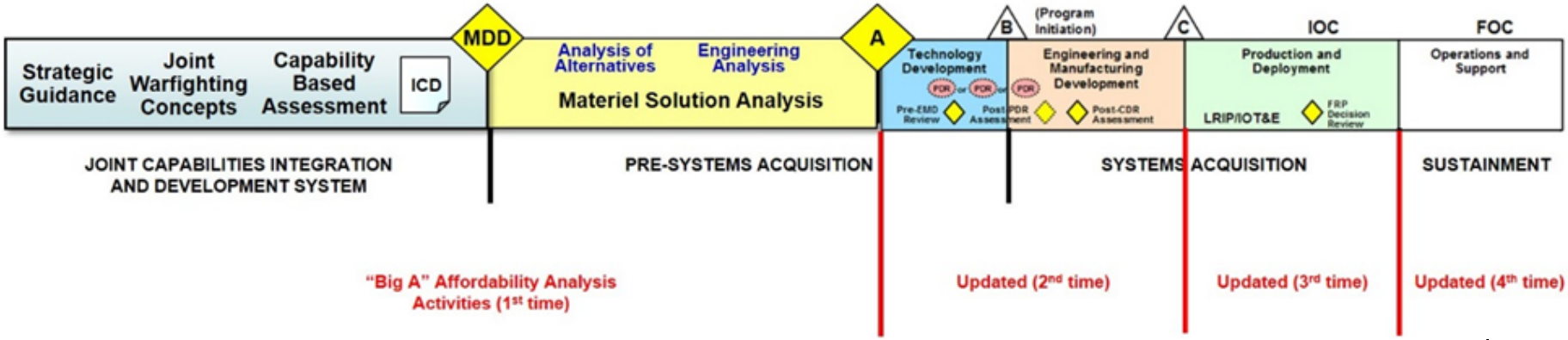


Affordability Execution



Affordability Throughout the Life Cycle

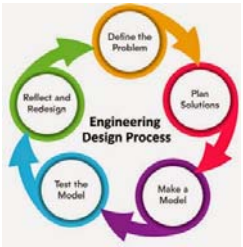
- **Affordability Analysis not just a "one & done" activity**
  - Not just pre-Milestone A
  - Affordability is a dynamic attribute and perishable
  - All inputs, measurement data collection, etc. and potentially the analysis should be reviewed each time through the acquisition life cycle



MORS Affordability Analysis: Communities

- **Analysis**
  - o Cost Analysis
  - o Decision Analysis
  - o Economic Analysis
  - o Operations Analysis

- **Engineer**
  - o Systems Architecture
  - o Systems Engineering



- **Other**
  - o Measurement
  - o Program / Project Management
  - o Visualization

Affordability Analysis & Measurement Terminology

- **Information Needed (Affordability Analysis)**
  - o Affordability Analysis term to gather information for the analysis
  - o Gathered during Affordability Analysis Activity # 1 – Requirements and Needs (examples on slide 29)
  - o Additional information may be collected as a activity inputs to complete Affordability Analysis Activities # 2 - 4
- **Information Needs (Measurement)**
  - o Specific information needs to develop measures based on all the available information needed for the affordability analysis
  - o The measurement "information needs" description will be used in this workshop
  - o Specific measurement "information needs" will be discussed in this workshop

Overview of AA Activity # 1: Requirements & Needs

Q1 What is the mission and outcome [this capability] is trying to impact?

- Mission & Outcomes Impacted – Review Strategic Guidance, Defense Planning Guidance, Integrated Priority List, Future Studies, Threat Analyses, Service Roles & Missions, and Congressional Inputs* to consolidate and refine the requirements or needs for the affordability issue in question.

Q2 What are the desired outcomes? How will we know they are achieved?

- Desired Outcomes & Recognizing Achievement – List and tier (e.g., MC / ME / MS) outcomes (with associated criteria, metrics, sources of data for metrics, including M&S or studies) to articulate authoritative/valid rationale for what will become a value proposition.

Q3 Which capability's resource decisions will affect this desired change?

- Capability Resources Affecting the Desired Outcome – Align existing budget data, stakeholders, and guidance to the established scope of the affordability analysis. Identify stakeholders and roles.

*Concerns from stakeholders such as the Defense Industrial Base are presumed to be captured in Congressional inputs, or directly to the effort at hand.

General Types of Affordability Analysis Inputs (Sources)

- Enterprise Plans **(Congress, OSD, JS, Nat'l CMD Authority or Intel CMD)**
- Operations Plans, Training Tactics & Procedures (TTPs), Joint Capability Concepts, Integrated Priority Lists (IPLs) – **(Combatant Commands or COCOMs, JS)**
- Operations Environment **(IC, Service Staffs & National Geospatial-Intelligence Agency)**
- Formal Requirements **(JCIDS: CBAs, AoA, ICD, CDD, CPD, LCCE)**
- Research Documents & Technology / Modernization Roadmaps **(Defense Advanced Research Projects Agency, Labs, GAO & Federally Funded Research & Development Centers)**
- Allied and Partner Agreements **(Congress, OSD & Department of State)**
- Future Studies & Analyses **(TRADOC and other similar Service organizations)**
- Recommended Capability Trades **(Think Tanks – Center for Strategic & Budgetary Assessments, Center for Strategic and International Studies, etc.)**
- Strategic Planning **(QDR, DPG & National Security Strategy)**
- Capability Studies **(FFRDC & University Affiliated Research Centers)**
- Rules of Engagement **(Title 10 & Joint Doctrine)**
- DoD Budget Request Data **(USD-Comptroller, OSD(CAPE) & Service 8's)**
- Incentives for Affordability Analysis **(OSD & Stakeholders)**

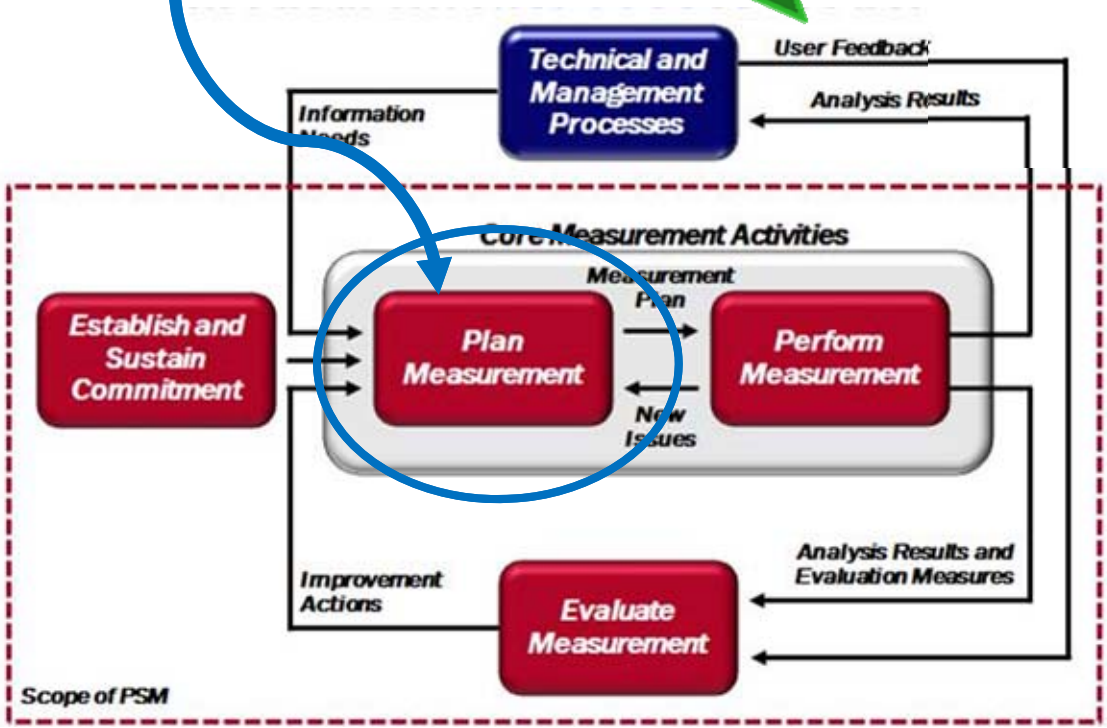
3 Breakout Sessions

- Brief Overview of the Activity
  - Activity # 2 – Assess Baseline & Gaps
  - Activity # 3 – Determine Feasible Alternatives
  - Activity # 4 – Evaluate Trade-Off Analysis
- Handouts
  - Each Participant
    - Hard copy of the 2 AA Activity # 1 slides
    - Hard copy of the Breakout Session Overview slides
    - Hard copy of the AA Activity slides in the breakout brief (2 slides per page)
  - In Breakout Session Room
    - Introduction / Background Brief (2 slides per page)
    - Measurement Example from Introduction
    - Detailed description of the specific Affordability Analysis Activity – Sec 2
    - Checklist of the Affordability Analysis Activity (with VSMs) – App B
    - Potential drivers, strategies, information needed, analyses & measures across the acquisition life cycle – App C.2

Measurement Process Model

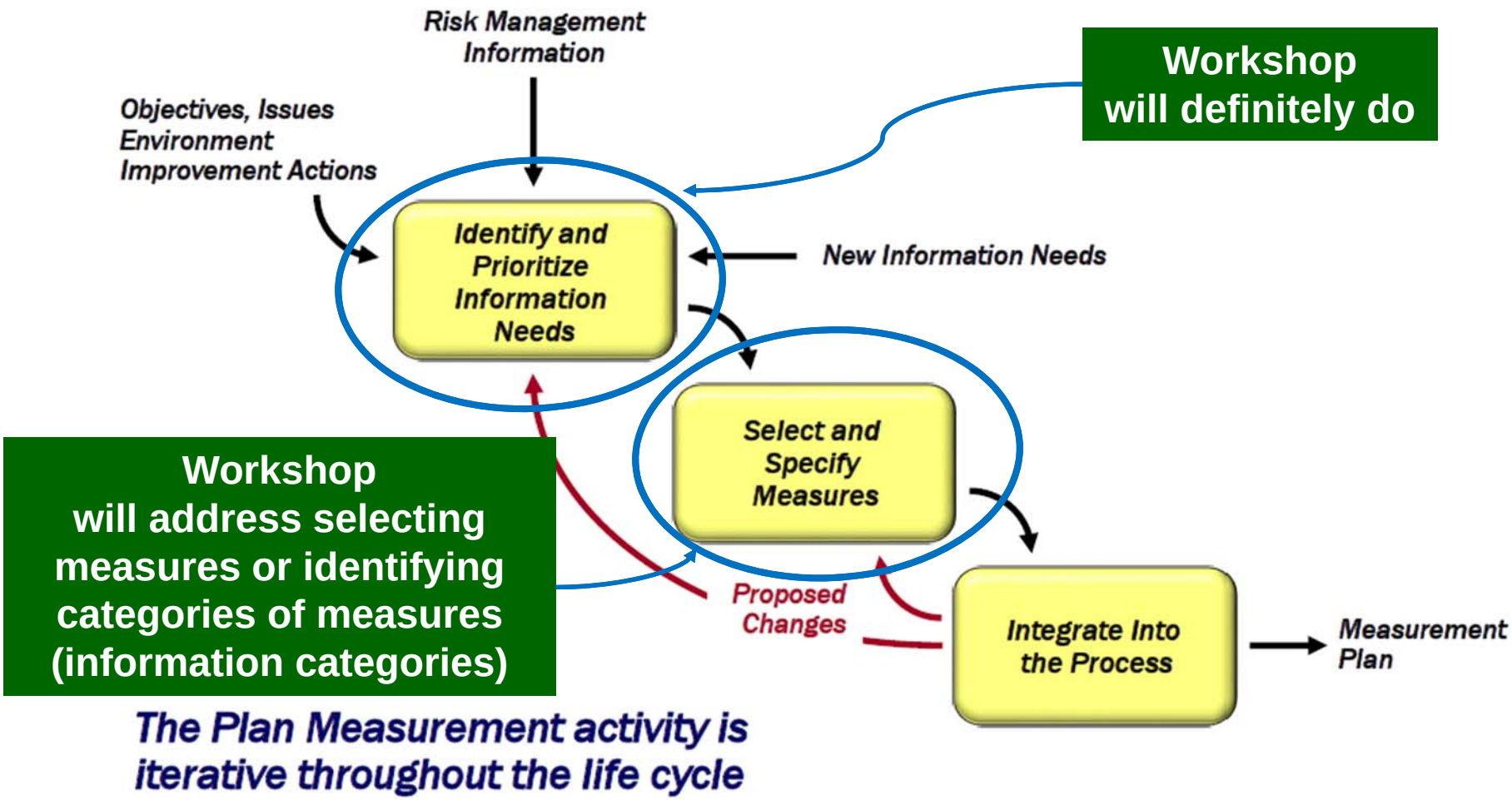
Workshop Will perform part of

Affordability Analysis Activities



Source: Figure 1-2: Practical Systems & Software Measurement Book (update)

Plan Measurement



Source: Figure 3-1: Practical Systems & Software Measurement Book

Breakout Session Focus

- Using the house buying as an example, the focus of this breakout session is to build a measurement process framework for a generic defense, commercial, or system solution situation for the "Assess Baseline & Gaps" Affordability Analysis Activity
- The resulting generic measurement process framework will be added to the MORS "Big A" Affordability Analysis Process after the workshop.

PSM ICM Chart Example

Information Category-Measureable Concept-Prospective Measures				
Information Categories	**Measurable Concepts**	**Questions Addressed**	**Measures**	
			Prospective Indicators	**Sample Base Measures**
Schedule and Progress	Milestone Completion	Is the project or service meeting scheduled milestones? Are critical tasks or delivery dates slipping?	- Milestone Progress	- Number of milestones started and completed versus plan
	Work Unit Progress	Are specific activities and products completed as scheduled?	- Requirements Progress - Problem Reports Progress - Reviews Progress - Change Requests Progress - System Elements (Units) Progress - Test Cases Progress - Action Items Progress	- Requirements defined, traced, verified, validated - Problem reports discovered, closed - Reviews completed - Change requests opened, resolved - System elements designed, implemented, integrated, approved, qualified, accepted - Test cases developed, attempted, passed - Action items opened, completed
	Work Backlog	Is the backlog of work units growing? Has the backlog of work units been adequately addressed?	- Work Unit Backlog Trends - Burndown Rates	- Work units in backlog, work units in backlog resolved
	Incremental Capability	Is capability being delivered as scheduled in incremental builds, releases, or service provisions?	- System Elements Integrated - Functionality Integrated	- Systems elements integrated (planned versus actual) - Functions integrated (planned versus actual)

Goal is to create an "Affordability Analysis" ICM Chart.
Can use information in the PSM ICM Chart.

Breakout Session Structure

- **Affordability Analysis Activity Overview**
- **Questions to be Discussed**: For any system, for the AAA exit criteria –
  - o What are the measurement information needs?
  - o What are the information categories?
  - o What are the measurement concepts?
  - o What are the questions to address the measurement concepts?
  - o What are prospective indicators?
  - o What are candidate potential base measures?
- **Other Discussion**:
  - o Information about measurement usage
  - o Measurement strategies & drivers (i.e., sources of information needs)

For some of the AAA # 2 Exit Criteria, the plan is to ask the above questions (10-15 minutes each). If time is available, then the "Other Discussion" will be considered.

House Buying Case Study

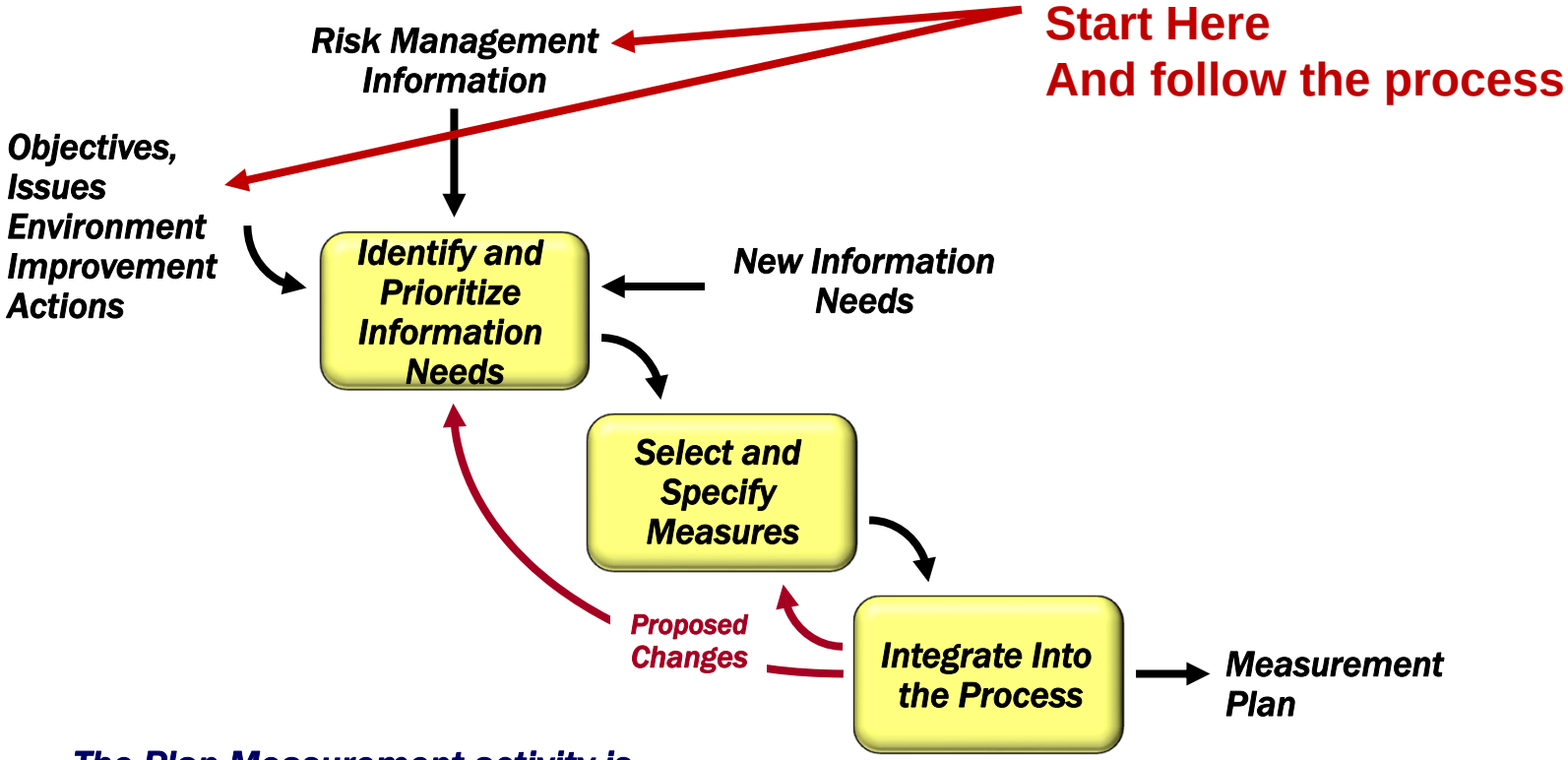
- A couple makes $100,000 per year.
- They see a nice house for $500,000. "Can we afford that?" they ponder.
- We all know that it depends.
  - How much of their budget can they allocate to the house?
  - What are the payments of the house itself?
    - How much can they put down?
    - What is the interest rate?
  - What are the expected utility bills?
  - What are the expected taxes?
  - Will the house increase or decrease in value?
  - Will they have to change lifestyles to afford the house?
- Should they look for an apartment instead?

Place to Live Considerations

Cost Considerations	Performance Considerations
Buy or Rent	House a family of 4
Down payment or deposit available	Easy access to work
Monthly payment within budget	Efficient utilities
Yearly payments within budget (HOA, Taxes, Insurance)	Low maintenance costs
Remodeling costs within budget?	Safe neighborhood
Expected utilities within budget?	Good Schools
	Close to hospital
	Positive investment (gain in value)

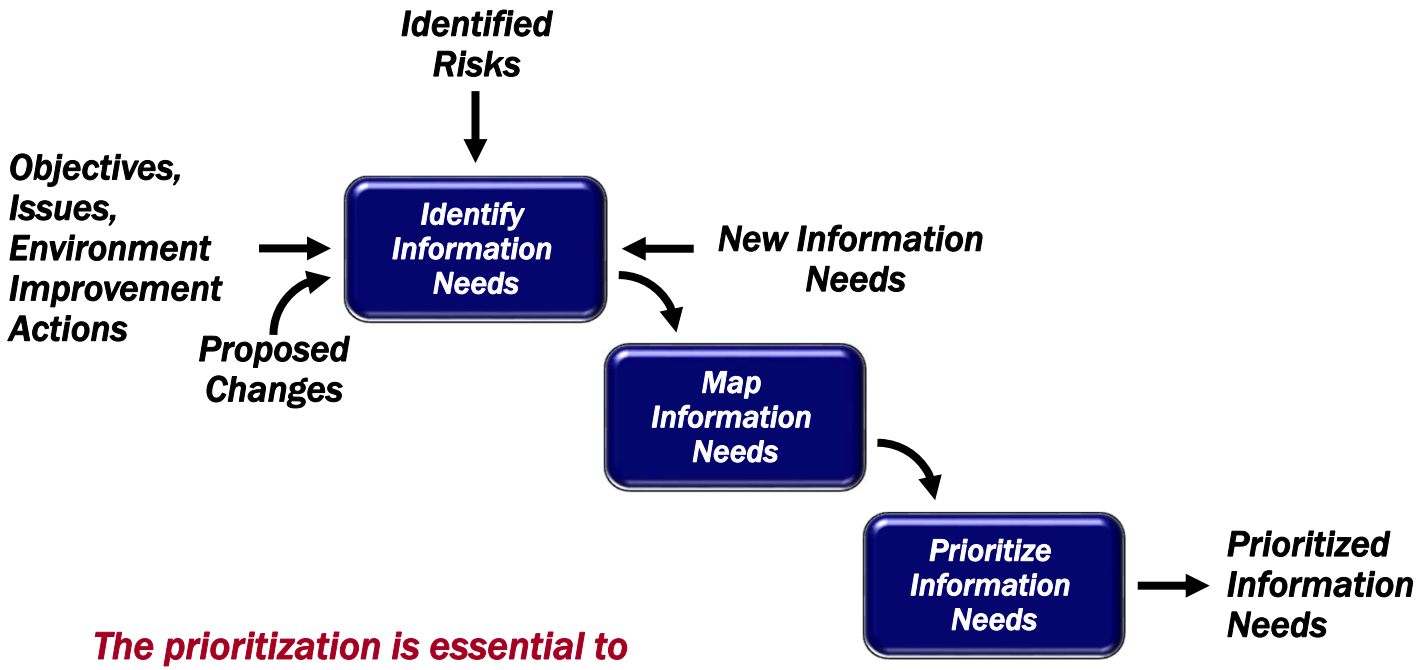
- What information do we need about these considerations to help us make our decisions?
- How do we get the information?

Plan Measurement



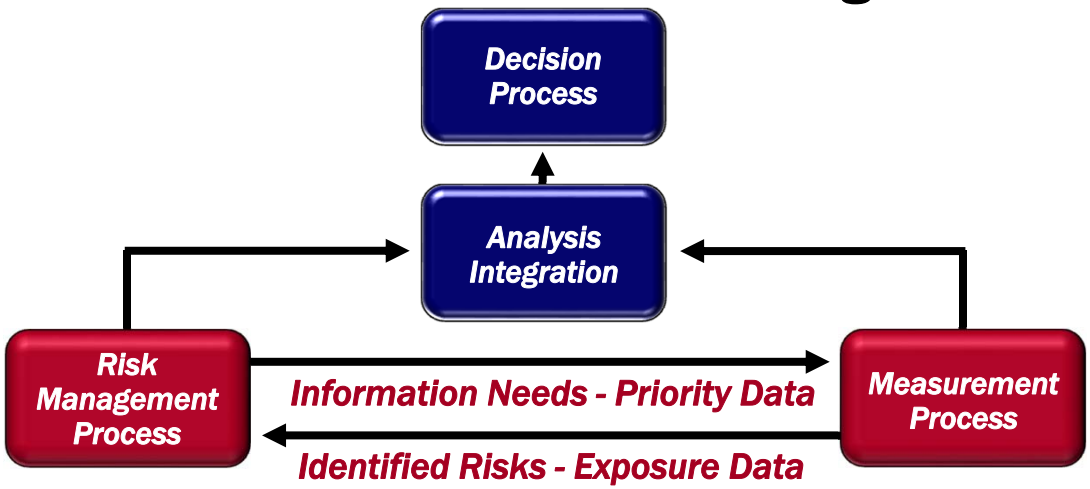
The Plan Measurement activity is iterative throughout the life cycle

Identify and Prioritize Information Needs



The prioritization is essential to ensure that the measurement efforts focus on what is most important

Measurement and Risk Management



- *Future events*
- *Expansive scope of information and issues*
- *Not easily measureable*
- *Wider uncertainty - less tangible*
- *Largely subjective data*
- *Complex interactions and interdependencies*
- *Establishes priorities*

- *Current events*
- *Narrower scope of information and issues*
- *Objective data - easier to define*
- *Quantifiable relationships*
- *Defines triggers*

Prioritizing Considerations

Considerations	Description	Priority
Buy or Rent	Should they buy or rent or does it matter?	1
Down payment or deposit available	Do they have an adequate down payment or deposit?	7
Monthly payment within budget	Do they have the budget for the monthly payments?	6
Yearly payments within budget	Do they have budget for any annual costs?	10
Remodeling costs within budget?	Can they afford any remodeling if needed?	13
Expected utilities within budget?	Will the utility bills be more or less and do they have budget?	9
House a family of 4	To house the family they need 3 bedrooms and 2 bathrooms.	2
Easy access to work	Residence should be less than 45 min to work	5
Efficient utilities	House / apartment should keep utilities less than or equal to current	8
Low maintenance costs	House/apartment should not require high maintenance	14
Safe neighborhood	House/apartment should be safe for children with low crime rate.	3
Good Schools	Schools should be rated Excellent	4
Close to hospital	House/ apartment should be less than 15 min from hospital/clinic	11
Positive investment (gain in value)	House /apartment will gain in value.	12

Measurement Information Needs for Cost Considerations

Considerations	Measurement Information Needs	Category	Measurement Concepts
Buy or Rent (P1)	Is initial cost of ownerships greater than initial cost of renting? a. How much is down payment & closing costs to buy? b. How much is deposit for rental? Is periodic cost of ownership greater than periodic cost of renting? a. How much is monthly payment for owning? I. How much is monthly loan payment? II. How much is monthly escrow payment? i. How much is monthly insurance payment? ii. How much is monthly tax payment? b. How much is monthly rental payment? I. How much is monthly rental payment? II. How much is monthly insurance payment? Is annual cost of ownership greater than annual cost of renting? a. How much is owner HOA costs? b. Are there other annual owner costs? c. Are there any annual rental costs? Is 20 year cost of ownership greater than 20 year cost of renting?	Cost	C1: Is initial cost of ownership > initial cost of renting? Initial cost of ownership = down payment + closing costs Initial cost of renting = deposit C2: Is periodic cost of ownership > periodic cost of renting? Periodic cost of ownership = monthly loan payment + monthly escrow payment Monthly loan payment = Function(principle, term in months, loan rate) Loan rate = Function(credit rating, principle, term in months) Credit rating = Function(income, debt) Monthly escrow payment = monthly insurance + yearly tax payment/12 Periodic cost of renting = monthly rental payment + monthly renters insurance C3: Is annual cost of ownership > annual rental cost Annual cost of ownership = HOA Annual cost of rental = 0. No other annual costs. C22: 20 year cost of ownership >= 20 year cost of renting? C23: Is own or rent cheaper based on annual cost? C24: Ratio of owning or rent for $/square foot? C25: Smaller $ per ft

Measurement Information Needs for Cost Considerations #2

Considerations	Measurement Information Needs	Category	Measurement Concepts
Down payment or deposit available (P7)	Is initial cost of ownership, or initial cost of renting available? If selling first, how much equity in existing home will be available? How much is down payment? How much is deposit?	Cost	C12: Is initial funding > down payment (Initial cost of ownership)? Initial Funds = savings + available equity Available Equity = Sale Price of current home - principle Initial cost of ownership (see above) C13: Is initial funding > deposit (initial cost of renting)? Initial cost of renting (see above)
Monthly payment within budget (P6)	Are periodic payments available? How much is monthly payment? How much is monthly payment budget?	Cost	C10: periodic funding > monthly ownership payment Periodic Funding = Net monthly income – monthly utilities – monthly living costs – monthly savings Net monthly income = ($100K / 12) – taxes – insurance – retirement Monthly utilities = electric+phone+water Monthly living costs = food+gasonline+medical+car+insurance Monthly ownership payment = Periodic cost of ownership (see above) C11: periodic funding > monthly rental payment Monthly rental payment > Periodic cost of renting (see above)

Measurement Information Needs for Cost Considerations #3

Considerations	Information Needs	Category	Measurement Concept
Yearly payments within budget (P10)	Are yearly payments available? How much are yearly payments? How much is budget for yearly payments?	Cost	C16: Annual payment budget > annual owner payments C17: Annual payment budget > annual rental payments Annual payment budget = savings Annual owner payments = HOA dues Annual rental payments = 0.
Remodeling costs within budget? (Owner only) (P13)	Are remodeling costs available? Is remodeling needed? If yes, how much is estimate? How much is available to pay for remodeling?	Cost	C20: Remodeling budget >= remodeling costs? Remodeling budget = savings + temporary loan Remodeling costs = # Rooms * (floor+wall+ceiling+paint)
Expected utilities within budget? (P9)	Are expected utility payments available? How much is existing utilities? How much will new utilities be? How much is available for monthly utilities?	Cost	C15: Utility budget >= Utility costs See above for Monthly payment within budget.

Measurement Information Needs for Performance Considerations

Considerations	Information Needs	Category	Measurement Concept
House a family of 4 (P2)	Does the house have 3 or more bedrooms? Does the house have 2 or more bathrooms?	Performance	C4: # of bedrooms >= 3 C5: # of bathrooms >= 2 C24: larger living area
Easy access to work (P5)	Is commute time less than 45 minutes? How long is mass transit time? Option A How long is car commute time? Option B Is commute cost less than 1 hour work? How much does mass transit cost? Option A What is car cost for commute? Option B How much is one hour wage?	Performance	C8: Commute time < 45 minutes Commute time option A = time to station + station to station + station to work Commute time option B = Distance to work / average speed + traffic delays Average speed = sum of speed limits / # of speed limits Traffic delays = # of construction sites * construction delay + # of traffic congestion sites * congestion delay C9: Commute cost < 1 hour wage Commute cost Option A = mass transit cost + 2* cost to drive to station Commute cost option B = Monthly car payment *(commute mileage/monthly mileage) + Monthly gasoline cost *(commute mileage/monthly mileage)
Efficient utilities (P8)	Is expected utility usage lower than current? What is expected electric usage ? What is current electric usage ? What is expected water usage ? What is current water usage ?	Performance	C14: Expected utilities <= current utilities Expected utilities = expected electric + expected water Current utilities = current electric + current water

Measurement Information Needs for Performance Considerations #2

Considerations	Information Needs	Category	Measurement Concept
Low maintenance components (P14)	Is annualized maintenance and repair costs < ½ house payment?	Quality	C21: is annualized maintenance / repair costs <= house payment?
Safe neighborhood (P3)	Is crime rate lower than average? What is crime rate?	Performance	C6: Crime rate < ½ average crime rate of city Crime rate = # of crimes per capita of the area # of crimes for area available from police Capita of area available from city records
Good Schools (P4)	Are schools rated exceptional? What are schools rated?	Performance	C7: School rating >= Exceptional School rating available from school district office Exceptional rating from school district office
Close to hospital (P11)	What is distance to nearest hospital/clinic?	Performance	C18: Is distance to hospital <= 5 miles? Distance to hospital = driving distance from house to hospital
Positive investment (gain in value) (P12)	Are houses in the area gaining in value?	Performance Cost	C19: Is expected gain in value > 5%/year Expected gain in value can be obtained from city tax records Include principle paid off with payments.

Specify Measures: Measurement Construct

Concept	Base & Derived Measures	Sources
C1: Is initial cost of ownership > initial cost of renting?	C1D1: Initial cost of ownership = down payment + closing costs	
	C1D2: Down payment = % down * buying price of house	
	C1D3: Closing costs = % closing costs * buying price of house	
	C1D4: initial cost of renting = deposit + first and last months rent	
	C1B1: % down	Mortgage Company
	C1B2: Closing costs (%)	Mortgage Company
	C1B3: = C1D4	Rental Agency
	C1B4 buying price of house	Mortgage Company
	C1B5: rent deposit	Rental Agency
	First and last month rent see C2B7 below	

Specify Measures: Measurement Construct # 2

Concept	Base & Derived Measures	Sources
C1: Is initial cost of ownership > initial cost of renting?	C1D1: Initial cost of ownership = down payment + closing costs	
	C1D2: Down payment = % down * buying price of house	
	C1D3: Closing costs = % closing costs * buying price of house	
	C1D4: initial cost of renting = deposit + first and last months rent	
	C1B1: % down	Mortgage Company
	C1B2: Closing costs (%)	Mortgage Company
	C1B3: = C1D4	Rental Agency
	C1B4 buying price of house	Mortgage Company
	C1B5: rent deposit	Rental Agency
	First and last month rent see C2B7 below	

Specify Measures: Measurement Construct # 3

Concept	Base & Derived Measures	Sources
C3: Is annual cost of ownership > annual rental cost	C3B1: Annual cost of ownership = HOA C3B2: Annual cost of rental = 0. No other annual costs.	HOA Rental Agency
C4: # of bedrooms >= 3	C4B1: # of bedrooms in house floor plan C4B2: # of bedrooms in rental	Builder Apartment manager
C5: # of bathrooms >= 2	C5B1: # of bathrooms in house C5B2: # of bathrooms in rental	Builder Apartment manager
C6: Crime rate < ½ average crime rate of city Lowest Crime Rate	C6D1: Crime rate owner area= # of crimes in owner area / Capita of owner area C6D2 Crime rate of city = # crimes in city / Capita of city C6D3 Crime rate of rent area = # crimes in rental area / capita of rental area C6B1: # of crimes for owner area C6B2: # of crimes for city C6B3: Capita of owner area C6B4: Capita of city C6B5: # crimes for rental area C6B6: capita of rental area	 Police Dept Police Dept City Records City Records Police dept City records
C7: School Rating >= Exceptional	C7B1: Owner School rating C7B2: Rental School rating C7B3: Exceptional rating	available from school district office Available from school district office Available from school district office

Specify Measures: Measurement Construct # 4

Concept	Base & Derived Measures	Sources
C8: Minimum Commute time between driving, train, or bus for owning and renting. Commute time one way < 45 minutes	C8D1: Commute time owner train = Avg owner time to train + Avg owner on train + Avg owner train to work C8D2: Commute time owner driving = Owner Distance to work / owner average speed + owner traffic delays C8D3: Owner Average speed = Owner Distance to work / Owner time to work C8D4: Owner Traffic delays = # of owner construction sites * owner construction delay + # of owner traffic congestion sites * owner congestion delay C8D5: Avg owner Time to train = sum 10 trips to owner station / 10 C8D6: Avg owner on train = sum 10 trips on owner train / 10 C8D7: Avg owner train to work = sum 10 trips owner train to work / 10 C8D8: Owner Distance to work = owner OD at work – owner OD at home C8D9: Owner Time to work = owner time at work – owner time at home	
	C8B1: # of owner construction sites	Counted over route to work
	C8B2: owner construction delay	Measured time in construction with watch, Car, and route to work
	C8B3: # of owner traffic congestion sites	Counted over route to work
	C8B4: owner Congestion delay	Measured time in congestion with watch, Car, and route to work

Specify Measures: Measurement Construct # 5

Concept	Base & Derived Measures	Sources
C8: Minimum Commute time between driving, train, or bus for owning and renting. Commute time one way < 45 minutes For owning and rental (continued)	C8B5: Trip to owner station	Measured with watch and car from home to station
	C8B6: trip on owner train	Measured with watch and train from station to station
	C8B7: trip owner train to work	Measured with watch and walking from station to work
	C8B8: Owner OD at work	Odometer reading at work
	C8B9: Owner OD at home	Odometer reading at home
	C8B10: Owner time at work	Watch time at work
	C8B11: Owner time at home	Watch time at home
	C8D10: Commute time owner bus = Avg owner time to bus + Avg owner time on bus + Avg owner time from bus	
	C8D11: Avg owner time to bus = sum 10 trips to bus / 10	Measured with watch and car
	C8D12: Avg owner time on bus = sum 10 trips on bus / 10	Measured with watch and bus
	C8D13: Avg owner time from bus = sum 10 trips from bus / 10	Measured with watch while walking
	C8D14: Commute time rent train = Avg rent time to train + Avg rent on train + Avg rent train to work	
	C8D15: Commute time rent driving = rent Distance to work / rent average speed + rent traffic delays	
	C8D16: Commute time rent bus = Avg rent time to bus + Avg rent time on bus + Avg rent time from bus	
	C8D17: rent Average speed = rent Distance to work / rent time to work	
	C8D18: Rent Traffic delays = # of rent construction sites * rent construction delay + # of rent traffic congestion sites * rent congestion delay	
	C8D19: Avg rent Time to train = sum 10 trips to rent station / 10	

Specify Measures: Measurement Construct # 6

Concept	Base & Derived Measures	Sources
C8: Minimum Commute time between driving, train, or bus for owning and renting. Commute time one way < 45 minutes For owning and rental (continued)	C8D19: Avg rent time to train = sum 10 trips to train/10	
	C8D20: Avg rent on train = sum 10 trips on rent train / 10	
	C8D21: Avg rent train to work = sum 10 trips rent train to work / 10	
	C8D22:rent Distance to work = rent OD at work – rent OD at home	
	C8D23: rent Time to work = rent time at work – rent time at home	
	C8B12: # of rent construction sites	Count with car and route to work
	C8B13: rent construction delay	Measured with watch and car on route to work
	C8B14: # of rent traffic congestion sites	Count with car and route to work
	C8B15: rent Congestion delay	Measured with watch and car on route to work
	C8B16: Trip to rent station	Measured with watch and car from rent to station
	C8B17: trip on rent train	Measured with watch and train from station to station
	C8B18: trip rent train to work	Measured with watch and walking from station to work
	C8B19: Rent OD at work	Odometer reading at work
	C8B20: Rent OD at home	Odometer reading at rental
	C8B21: Rent time at work	Watch time at work
	C8B22: Rent time at home	Watch time at rental
	C8D24: Avg rent time to bus = sum 10 trips to bus/10	
	C8D25: Avg rent time on bus = sum 10 trips on bus/10	
	C8D26: Avg rent time from bus = sum 10 walks from bus / 10	

Specify Measures: Measurement Construct # 7

Concept	Base & Derived Measures	Sources
C9: Minimum Commute cost between driving, train, or bus for owning and renting. Commute cost < 1 hour wage	C9D1: Commute own cost train = 2* own train cost + 2* own cost to drive to train	
	C9B1: own train Cost	Transit company
	C9D2: own cost to drive to train = (own distance to train) / (avg miles/gal) * (avg $ / gal)	
	C9B2: Owner distanced to train	Measured with car
	C9D3: avg miles / gal = Test miles / test gallons	
	C9B3: Test miles	Test miles measured with car
	C9B4: Test Gallons	Measured at pump after test miles
	C9D4: avg $ / gal = sum price over 5 stations / 5	Measured over 5 gas stations close to home
	C9D5: Commute own cost drive = Monthly car payment *(owner commute mileage/monthly mileage) + Monthly gasoline cost *(owner commute mileage/monthly mileage) + Monthly Car Insurance * (owner commute mileage/monthly mileage)	
	C9B5: Monthly car payment	Car loan company
	Owner distance to work (C8D8)	See C8D8 Above
	C9D6: Monthly mileage = OD end of month – OD beg of month	
	C9B6: Monthly gasoline cost	Measured with credit card used only for gas
	C9B7: Monthly car insurance	CAR Insurance company
	C9D8: Hourly wage = income / (40 hrs/wk * 52 wks)	Payroll department
	C9B9: OD end of month	Car odometer reading at end of month
	C9B10: OD at beg of month	Car odometer reading at beginning of month

Specify Measures: Measurement Construct # 8

Concept	Base & Derived Measures	Sources
C9: Minimum Commute cost between driving, train, or bus for owning and renting. Commute cost < 1 hour wage (Continued)	C9D7: Commute own cost bus = 2* own bus cost + 2*own cost to drive to bus	
	C9B11: Own bus cost	Bus company
	C9D8 Owner cost to drive to bus = (Owner distance to bus)/(avg miles / gal) * (avg $ /gal)	
	C9B12: owner distance to bus	Measured with car and watch
	C9D9: Commute rent cost train = 2* rent train cost + 2* rent cost to drive to train	
	C9B13: rent train Cost	Transit company
	C9D10: rent cost to drive to train = (rent distance to train) / (avg miles/gal) * (avg $ / gal)	
	C9B12: Rent distance to train	Measured with car
	C9D11: Commute rent cost drive = Monthly car payment *(rent commute mileage/monthly mileage) + Monthly gasoline cost *(rent commute mileage/monthly mileage) + Monthly Car Insurance * (rent commute mileage/monthly mileage)	
	See C8D22 Rent commute mileage	
	C9D12: Commute rent cost bus = 2* rent bus cost + 2*rent cost to drive to bus	
	C9B13: rent bus cost	Bus company
	C9D13: Rent cost to drive to bus = (rent distance to bus)/(avg miles/gal)*(avg$/gal)	
	C9B14: Rent distance to bus	Measured with car

Specify Measures: Measurement Construct # 9

Concept	Base & Derived Measures	Sources
C10: periodic funding > monthly ownership payment	C10D1: Periodic Funding = Net monthly income – monthly utilities – monthly living costs – monthly savings	
	C10D2: Net monthly income = ($100K / 12) – taxes – health insurance – retirement	
	C10D3: Monthly utilities = electric + phone + water	
	C10D4: Monthly living costs = food + gasoline + medical + Monthly car insurance	
	C10B1: Monthly savings	Pay stub
	C10B2: taxes	Pay stub
	C10B3: health insurance	Health insurance company
	C10B4: retirement	Human resources (pay stub)
	C10D5: electric = sum of last 12 months electric bill / 12	
	C10B5: last 12 electric bills	Electric company
	C10D6: phone = sum of last 12 phone bills / 12	
	C10B6: last 12 phone bills	Phone company
	C10D7: water = sum of last 12 water bills / 12	
	C10B7: last 12 water bills	Water company
	C10D8: food = sum of last 12 months food bills / 12	
	C10B8: last 12 months food bills	Bank statement or receipts
	C10D9: gasoline = sum of last 12 months gasoline bills / 12	
	C10B9: last 12 months gasoline bills	Bank statement or receipts
	C10D10: medical = sum of last 12 months medical bills / 12	
	C10B10: last 12 months medical bills	Bank statement or receipts
	Monthly Car insurance	See C9B7 above
	Monthly ownership payment = Periodic cost of ownership	see C2D1 above

Specify Measures: Measurement Construct # 10

Concept	Base & Derived Measures	Sources
C11: periodic funding >= monthly rental payment	Periodic funding Monthly rental payment = Periodic cost of renting	See C10D1 above See C2D6 Above
C12: initial funding >= down payment	C12D1: Initial Funding = savings + available equity C12B1: Savings balance C12D2: Available equity = value of current home - current principle – cost to sell current home C12B2: Value of current home C12B3: Current principle C12B4: Cost to sell current home Down payment = Initial Cost of Ownership	 Bank statement Appraiser or realtor Current mortgage company Realtor See C1D1 Above
C13: initial funding >= deposit (initial cost of renting)	Initial cost of renting Initial Funding	See C1B3 Above See C12D1 Above
C14: Expected utilities <= current utilities	C14D1: Expected owner utilities = expected owner electric + expected owner water C14D2: Expected rental utilities = expected rent electric + expected rent water Current utilities = Monthly utilities C14B1: expected owner electric C14B2: expected owner water C14B3: expected rental electric C14B4: expected rental water	 See C10D3 Above Builder, Realtor, electric company Builder, Realtor, water company

Specify Measures: Measurement Construct # 11

Concept	Base & Derived Measures	Sources
C15: Utility budget >= Utility costs	Utility budget = Monthly utilities Utility costs = expected utilities	See C10D3 above See C14D1 above
C16: Annual payment budget > annual owner payments	C16D1: Annual payment budget = sum of monthly savings Annual owner payments = HOA dues C16B1: monthly savings	 See C3B1 above Bank statement
C17: Annual payment budget > annual rental payments	Annual Payment budget C17B1: Annual rental payments = 0.	See C16D1 above Rental agency
C18: Is distance to hospital <= 5 miles?	C18D1: Distance to hospital = driving distance from house to hospital C18B1: Driving distance from house to hospital	 Measured with car
C19: Is expected gain in value > 5%*value	C19D1: Expected yearly gain in value = (current value – last year value) / last year value C19B1: current value C19B2: last year value C19D2: percent gain	 City tax records City tax records

Specify Measures: Measurement Construct # 12

Concept	Base & Derived Measures	Sources
C20: Remodeling budget >= remodeling costs?	C20D1: Remodeling budget = current savings + temporary loan	
	C20D2: Remodeling costs = # Rooms * (floor + wall + ceiling + paint)	
	C20B1: current savings	Bank statement
	C20B2: Temporary loan	Bank loan dept
	C20B3: # rooms	Floor plan
	C20B4: Floor remodeling cost	Remodeling company estimate
	C20B5: Wall remodeling cost	Remodeling company estimate
	C20B6: Ceiling remodeling cost	Remodeling company estimate
	C20B7: paint cost	Remodeling company estimate

Specify Measures: Measurement Construct # 13

Concept	Base & Derived Measures	Sources
C21: Is annualized maintenance costs <= house payment	C21D1: Annualized maintenance cost = (20 year Maintenance / repair cost) / 20 = (cost to replace roof/average roof life) + (cost to replace AC / average AC life) + (cost to replace hot water heater / average hot water life) + (cost to repaint / average life of paint) + (cost to recarpet / average carpet life) + (cost for clothes washer / average life of washer) + (cost for clothes dryer / average life of dryer) + (cost to replace garage opener / average life of opener)	
	C21D2: Ratio of annualized maintenance cost to house payment	
	C21B1: Cost to replace roof	Estimate from roofer
	C21B2: average roof life	Estimate from roofer
	C21B3: Cost to replace AC	Estimate from AC repair company
	C21B4: average AC life	Estimate from AC repair company
	C21B5: cost to replace hot water heater	Estimate from plumber
	C21B6: average hot water life	Estimate from Home Depot
	C21B7: cost to repaint	Estimate from painter
	C21B8: average life of paint	Estimate from painter
	C21B9: cost to re-carpet	Estimate from flooring company
	C21B10: average carpet life	Estimate from flooring company
	C21B11: cost for clothes washer	Estimate from Home Depot
	C21B12: average life of washer	Estimate from Home Depot
	C21B13: cost for clothes dryer	Estimate from Home Depot
	C21B14: average life of dryer	Estimate from Home Depot
	C21B15: cost to replace garage opener	Estimate from Home Depot
	C21B16: average life of opener	Estimate from Home Depot
	House payment = periodic ownership cost	See above

Specify Measures: Measurement Construct # 14

Concept	Base & Derived Measures	Sources
C22: 20 year cost of ownership >= 20 year cost of renting	C22D1 20 yr cost of ownership = Initial cost of ownership + 20*12*periodic cost of ownership + 20* annual cost of ownership + 20 * annualized cost of maintenance – 20 * yearly gain in owner value - 20*yearly savings from owning-20 year paid principle	
	C22D2 20 yr cost of renting = initial cost of renting + 20*12 * periodic cost of renting – 20*yearly gain in renting value -20 * yearly savings from renting	
	C22D3 yearly savings from renting = 12*(periodic cost of ownership – periodic cost of renting) + (annual cost of ownership – annual cost of renting)	
	C22D4 yearly savings from owning = 12 * (periodic cost of renting – periodic cost of ownership) + (annual cost of renting – annual cost of ownership)	
	C22D5: Sum of rent with bi-annual increases in rent = sum of rent for years including bi-annual increase = 20 year * (rent*(1+percent increase^# of increases)	
	C22D6: final year difference between owning and renting = 12*(periodic cost of owning – periodic cost of renting)+12*(annual cost of owning – annual cost of renting)	
	C22B1 yearly gain in renting value = 0	Rental agency
	C22B2: bi-yearly rent increase	Rental agency
	C22B3 years of comparison (20 years)	

Specify Measures: Measurement Construct # 15

Concept	Base & Derived Measures	Sources
C23: ratio of 20 year cost of ownership / 20 year cost of renting	C23D1 20 yr cost of ownership / 20 yr cost of renting	
C24: ratio of living area for owner / rental	C24D1: Ratio of living area for owner / rental C24B1: Size of owning living space C24B2: Size of rental living space	 Home builder Rental angency
C25: $ per foot of owner living space vs $ per foot of rental living space	C25D1: Ratio of annual owning cost / owning living space = C22D1/C22B3/C24B1 C25D2: Ratio of annual rental cost / rental living space= C22D2/C22B3/C24/B2	

Example Measures & Values

Base Measures	Scenario Values
C1B1: Percent down	10%
C1B2: % closing	4%
C1B4: cost of house	500000
C1B5: rent deposit	$2000
C2B1: Principle	=C2D7
C2B2: Term in months	360
C2B3: Income	$100,000
C2B4: Debt	$10,000
C2B5: Monthly insurance cost	$2000
C2B6: Annual tax payment	$6500
C2B7: Monthly rental payment	$2000
C2B8: Monthly renters insurance	$100
C3B1: Annual cost of ownership = HOA	$500
C3B2: Annual cost of rental = 0.	0
C4B1: # of owner bedrooms in floor plan	5
C4B2: # of rental bedrooms	4
C5B1: # of owner bathrooms	3
C5B2: # of rental bathrooms	2
C6B1: # of crimes for owner area	25
C6B2: # of crimes for city	500
C6B3: Capita of owner area	15 k
C6B4: Capita of city	100 K
C6B5: # crimes for rental area	30
C6B6: capita of rental area	15K

Example Measures & Values # 2

Base Measures	Scenario Values
C7B1: Owning School rating	Excellent
C7B2: Rental school rating	Exceptional
C7B2: Exceptional rating	Exceptional
C8B1: # of owner construction sites	2
C8B2: owner construction delay	5 minutes
C8B3: # of owner traffic congestion sites	2
C8B4: Owner Congestion delay	3 minutes
C8B5: Trip to owner station	5 minutes
C8B6: owner trip on train	25 minutes
C8B7: owner trip to work	5 minutes
C8B8: OD at work	12,553
C8B9: OD at home	12,522
C8B10: Time at work	7:25
C8B11: Time at home	6:35
C8B12: # of rental construction sites	2
C8B13: rental construction delays	5
C8B14: # of rent traffic congestion	2
C8B15: rent traffic congestion delays	3
C8B16: trip to rent station	5
C8B17: trip on rent train	20
C8B18: trip rent train to work	5
C8B19: Rent OD at work	12620
C8B20: Rent OD at home	12590
C8B21: Rent time at work	7:30
C8B22: Rent time at home	6:40
C8B23: Rent trip to bus	5
C8B24: Rent time from bus	5
C8B25: Rent time on bus	30

Example Measures & Values # 3

Base Measures	Scenario Values
C9B1: Mass Transit Cost	$1.00
C9B2: Distanced to station	3 miles
C9B3: Test miles	300 miles
C9B4: Test Gallons	15
C9B5: Monthly car payment	$450.00
C9B6: Monthly gasoline cost	$200.00
C9B7: Monthly car Insurance	$150.00
C9B8: Hourly wage	C9:D14 =C2B3 / 2080 hrs = $48.08
C9B9: OD end of month	12,620
C9B10: OD at beg of month	10,505
C9B11: own bus cost	$2.50
C9B12: owner distance to bus	2
C9B13: rent train cost	$4.00
C9B14: Rent distance to train	3
C9B15: rent bus cost	$2
C9B16: rent distance to bus	3
C10B1: Monthly savings	$200.00
C10B2: taxes	1600
C10B3: health insurance	225
C10B4: retirement	200
C10B5: last 12 electric bills	=(125+135+132+140+180+205+190+145+130+155+185+180)=1902
C10B6: last 12 phone bills	=(85+85+85+85+85+85+85+85+85+85+85+85)=1020
C10B7: last 12 water bills	=(65+70+80+70+75+72+82+75+70+78+85+72)=894
C10B8: last 12 months food bills	=(360+420+450+400+470+460+400+380+360+380+350+410)=4840
C10B9: last 12 months gasoline bills	=(225+210+240+200+245+235+240+220+210+230+240+225)=2720
C10B10: last 12 months medical bills	= (150+150+65)=365

Example Measures & Values # 4

Base Measures	Scenario Values
C11 no base measures	N/A
C12B1: Savings balance C12B2: Value of current home C12B3: Current principle C12B4: Cost to sell current home	$3500 425,000 300,000 $25,500
C13 no base measures	N/A
C14B1: expected owner electric C14B2: expected owner water C14B3: expected rental electric C14B4: expected rental water	$165 $65 $150 $50
C15 has no base measures	N/A
C16B1: monthly savings	$200
C17B1: Annual rental payment	$0

Example Measures & Values # 5

Base Measures	Scenario Values
C18B1: Driving distance from house to hospital C18B2: Driving distance from rental to hospital	6 miles 5 miles
C19B1: current value C19B2: last year value	500,000 470,000
C20B1: current savings C20B2: Temporary loan C20B3: # rooms C20B4: Floor remodeling cost C20B5: Wall remodeling cost C20B6: Ceiling remodeling cost C20B7: paint cost	$3500 $20,000 4 $700 per room $100 per room $120 per room $80 per room

Example Measures & Values # 6

Base Measures	Scenario Values
C21B1: Cost to replace roof	=$28000
C21B2: average roof life	= 10 years based on weather and material life
C21B3: Cost to replace AC	= $3000
C21B4: average AC life	15 years
C21B5: cost to replace hot water heater	$500
C21B6: average hot water life	10 years
C21B7: cost to repaint	$2000
C21B8: average life of paint	15 years
C21B9: cost to re-carpet	= 3$/ft2 * 2000 square feet = 6000
C21B10: average carpet life	15 years
C21B11: cost for clothes washer	$500
C21B12: average life of washer	10 years
C21B13: cost for clothes dryer	$300
C21B14: average life of dryer	12 years
C21B15: cost to replace garage opener	$300
C21B16: average life of opener	10 years

Example Measures & Values # 7

Base Measures	Scenario Values
C22B1: yearly gain in rental value C22B2: bi-yearly rent in crease C22B3: years for cost comparison	$0 5% 20
C23 no new measures	
C24B1: Size of owning living space C24B2: size of renting living space	4200 2500
C25 no new base measures	

Considerations with Concepts Prioritized # 1

Considerations	Description	Priority
Buy or Rent	C1: Is initial cost of ownership > initial cost of renting? C2: Is periodic cost of ownership > periodic cost of renting? C3: Is annual cost of ownership > annual rental cost C22: 20 year cost of ownership >= 20 year cost of renting? C23: Annual cost of own >= annual cost to rent? C24: $/square foot own >= $ / square foot to rent? C25: Smaller $ per ft	1
House a family of 4	C4: # of bedrooms >= 3 C5: # of bathrooms >= 2 C24: larger living area	2
Safe neighborhood	C6: Crime rate < ½ average crime rate of city Crime rate rent < ½ average crime rate of city	3
Good Schools	C7: School own rating >= Exceptional School rating for rental >= Exceptional	4

Considerations with Concepts Prioritized # 2

Considerations	Description	Priority
Easy access to work	C8: Commute time < 45 minutes Owner train <= 45 Owner drive <= 45 Owner bus <= 45 Renter train <= 45 Renter drive <= 45 Renter bus <= 45 C9: Commute cost < 1 hour wage Owner train < 1 hour wage Owner drive < 1 hour wage Owner bus < 1 hour wage Renter train < 1 hour wage Renter drive < 1 hour wage Renter bus < 1 hour wage	5
Monthly payment within budget	C10: periodic funding > monthly ownership payment C11: periodic funding > monthly rental payment	6
Down payment or deposit available	C12: Is initial funding > down payment (initial cost of ownership)? C13: Is initial funding > deposit (initial cost of renting)?	7
Efficient utilities	C14: Expected utilities <= current utilities Owner utilities <= current Renter utilities <= current	8
Expected utilities within budget?	C15: Utility budget >= Utility costs Budget >= owner utilities Budget >= renter utilities	9

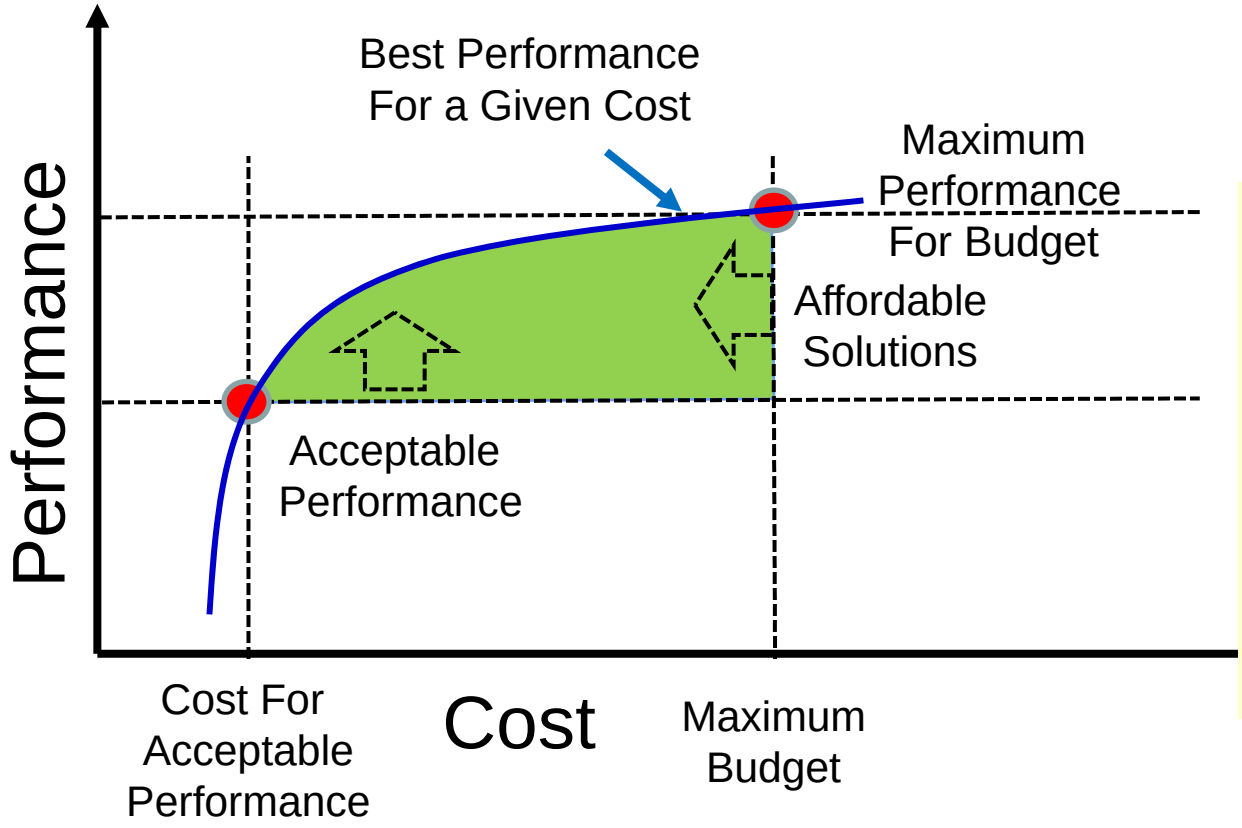
Considerations with Concepts Prioritized # 3

Considerations	Description	Priority
Yearly payments within budget	C16: Annual payment budget > annual owner payments C17: Annual payment budget > annual rental payments	10
Close to hospital	C18: Is distance to hospital <= 5 miles? Owner distance < 5 miles Renter distance < 5 miles	11
Positive investment (gain in value)	C19: Is expected gain in value > 5%/year (house only rental will not gain in value)	12
Remodeling costs within budget?	C20: Remodeling budget >= remodeling costs? (house only. Rental will not cost to remodel)	13
Low maintenance costs	C21: Is annualized maintenance / repair costs <= house payment? (house only. Rental will not cost to remodel)	14

Putting It All Together: Example Data for 10 Scenarios

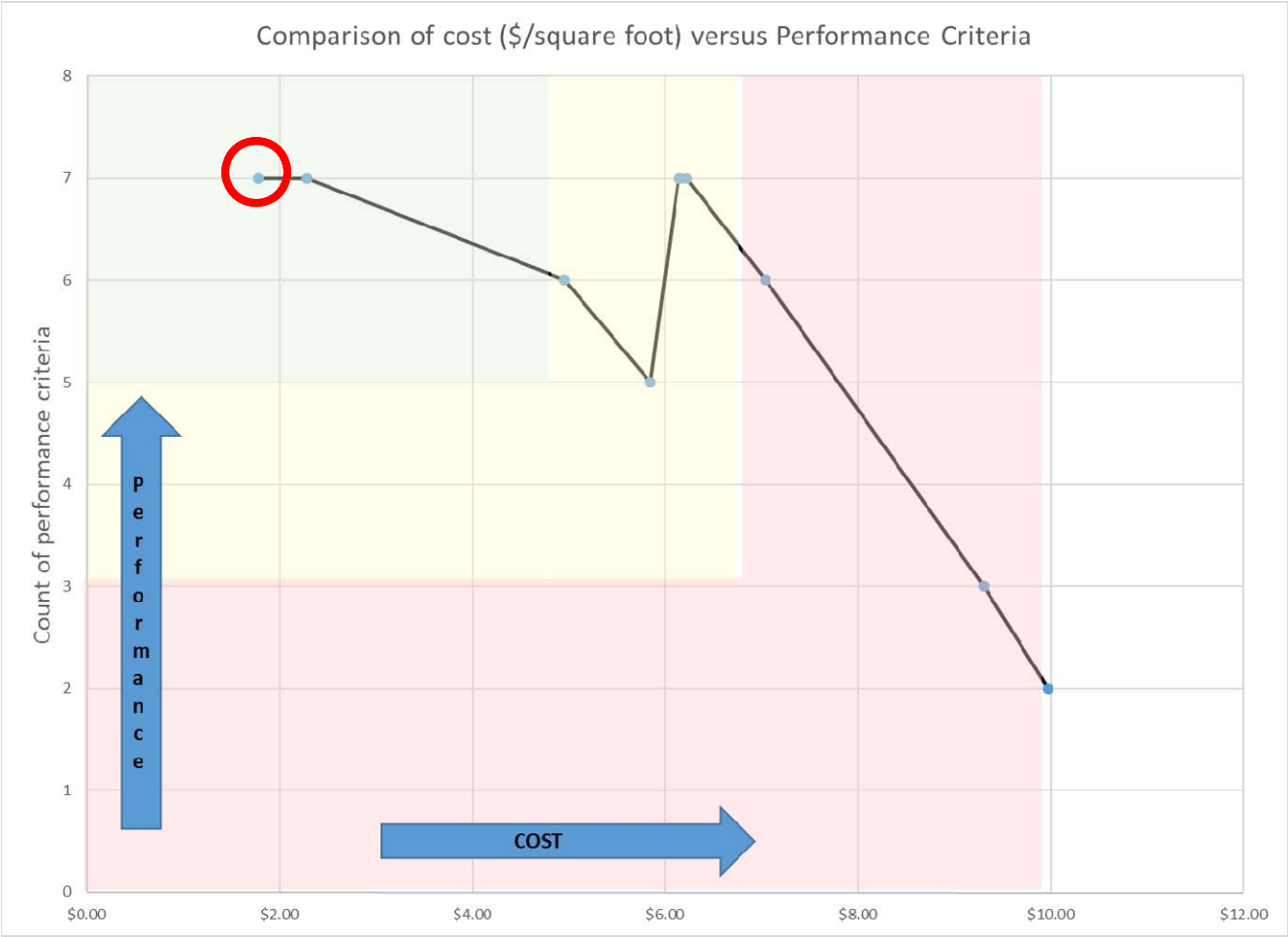
House $	Annual	Size	BR	Bath	School	Hospital	Comm $	Comm T	Crime	O/R	Perf	$/Ft^2
450K	$21552.94	3500	4	2	Exemplary	5	$2.56	35	.0021	O	7	$6/16
300K	$21,108.94	3000	4	2	Exceptional	6	$4.64	36	0.002	O	6	$7.04
500K	$20,819.09	4200	5	3	Exemplary	6	$2.56	35	0.001667	O	6	$4.96
NA	$15,542.61	2500	4	2	Exceptional	5	$4.56	40	0.002	R	7	$6.22
NA	$14,950.17	1500	2	1	Satisfactory	6	$3.52	41	0.0026	R	2	$9.97
NA	$13,953.46	1500	3	1	Satisfactory	7	$4.48	42	0.002533	R	3	$9.30
NA	$12,274.21	2000	3	2	Exceptional	5	$4.56	40	0.002	R	7	$6.14
NA	$10,529.91	1800	2	1	Exceptional	5	$4.30	35	0.002333	R	5	$5.85
350K	$7,319.86	3200	4	2	Exemplary	5	$4.30	30	0.001667	O	7	$2.29
280K	$4,966.64	2800	3	2	Exceptional	5	$4.85	35	0.002133	O	7	$1.77

"Big A" Affordability: Affordable AND Compliant



- Analyst would plot data from measures with acceptable and unacceptable ranges identified.
- Look across measures to identify houses with acceptable data points.

Putting It All Together: Example Data for 10 Scenarios # 2



Example Summary

- Based on scenario data.
  - Couple should not buy $500,000 home but go for a more conservative $280, 000 home with around 2800 square feet close to work, and hospital with good school and low crime rate in a growing neighborhood.
  - Renting is OK but size is more limited for family, crime rate is usually higher around apartments, and no gain in equity with rental so there is no long term value unless rent is low enough to save money and gain interest but that puts you in higher crime rate and smaller apartments.

Breakout Sessions and the Affordability Analysis Framework

Activity # 1 – Review Requirements, Needs & Desired Outcomes

- What is the mission and outcome I am trying to impact?
- What are the desired outcomes? How will I know they are achieved?
- Which capability's resource decisions will affect this desired outcome?

Is it needed? Are Requirements Properly assessed?

How much do we prefer this capability?

START

Activity # 2 – Assess Baseline and Gaps

- At what level do I resource this capability area? What areas of performance are going well? What is killing my budget?
- What are the most critical capability gaps to close or efficiencies to realize?

How much do we need it?

How much do we spend on related capabilities?

Is productivity and innovation incentivized?

Activity # 3 – Determine Feasible Alternatives

- What are choice approaches or courses of action (COA) needed to make needed changes? (Strategic, modernization, process, etc.)
- What are the alternatives to consider for each COA?
- How well does each perform? What is the risk? What is the 30-yr cost profile?

Is it a good deal we cannot pass up and why?

Are competitive methods used?

Activity # 4 – Evaluate Trade-Off Analysis

- How do these COA compare in net value to other elements in the portfolio?
- Do decision-makers at other levels need to be contacted?
- What is the best-value mix of investments in this portfolio?
- Are we "better off" than our prior portfolio? Within affordability boundaries?

Are BBP 2.0 / 3.0 initiatives leveraged? Is it worth the cost?

What are show stoppers we must attend to for success?

Breakout Session Overview

- (20 Min) Overview of respective AA Activity
- (70 Min) Breakout Sessions Discussions
  - Using the house buying as an example, the focus of the breakout session is to build a measurement process framework for a generic defense, commercial, or system solution situation for the respective Affordability Analysis Activity
  - The resulting generic measurement process framework will be added to the MORS "Big A" Affordability Analysis Process after the workshop.

PSM ICM Chart Example

Information Category-Measureable Concept-Prospective Measures				
Information Categories	**Measurable Concepts**	**Questions Addressed**	**Measures**	
			Prospective Indicators	**Sample Base Measures**
Schedule and Progress	Milestone Completion	Is the project or service meeting scheduled milestones? Are critical tasks or delivery dates slipping?	- Milestone Progress	- Number of milestones started and completed versus plan
	Work Unit Progress	Are specific activities and products completed as scheduled?	- Requirements Progress - Problem Reports Progress - Reviews Progress - Change Requests Progress - System Elements (Units) Progress - Test Cases Progress - Action Items Progress	- Requirements defined, traced, verified, validated - Problem reports discovered, closed - Reviews completed - Change requests opened, resolved - System elements designed, implemented, integrated, approved, qualified, accepted - Test cases developed, attempted, passed - Action items opened, completed
	Work Backlog	Is the backlog of work units growing? Has the backlog of work units been adequately addressed?	- Work Unit Backlog Trends - Burndown Rates	- Work units in backlog, work units in backlog resolved
	Incremental Capability	Is capability being delivered as scheduled in incremental builds, releases, or service provisions?	- System Elements Integrated - Functionality Integrated	- Systems elements integrated (planned versus actual) - Functions integrated (planned versus actual)

Goal is to create an "Affordability Analysis" ICM Chart.
Can use information in the PSM ICM Chart.

How will the Goals Be Achieved?

- **Questions to be Discussed**: For any system, for the AAA exit criteria –
  - What are the measurement information needs?
  - What are the information categories?
  - What are the measurement concepts?
  - What are the questions to address the measurement concepts?
  - What are prospective indicators?
  - What are candidate potential base measures?
- **Other Discussion**:
  - Information about measurement usage
  - Measurement strategies & drivers (i.e., sources of information needs)

For some of the AAA # 2 Exit Criteria, the plan is to ask the above questions (10-15 minutes each). If time is available, then the "Other Discussion" will be considered.

What are the Expected Outputs?

- **Breakout Session Output**: For any system, for the AAA Exit Criteria –
  - The answers to the questions will be collected which include:
    - Measurement information needs
    - Information categories
    - Measurable concepts
    - Questions to address the measurable concepts
    - Prospective Indicators
    - Potential candidate base measures
  - GOAL: Develop an Affordability Analysis Information Category – Measurement Concept – Prospective Measures (ICM) Table
  - The captured discussion including
    - Information about usage, such as timing
    - Measurement strategy & drivers

What are the Eventual Products?

- **Overview Products**:
  - o Generic measurement taxonomy framework
  - o PSM White Paper on what was accomplished
  - o Briefing to the MORS Measures of Merit Working Group at the 84th MORS Symposium
- **Future Tools**: (From the answers to the questions)
  - o Measurement Development Framework
  - o AA-Related Table of Candidate Measures
  - o Update to the MORS "Big A" Affordability Analysis Process

QUESTIONS?

BACK-UPS

MORS and Affordability Analysis

2013

In February 2013, ***MORS established an Affordability Analysis Community of Practice*** to meet regularly, complete unfinished items from the workshop, and build up the body of knowledge around affordability analysis with their "Affordability Research Document." The Affordability CoP determined that it would be ***valuable to use a Lean Six Sigma Value Stream Mapping approach to further develop the process.***

2014

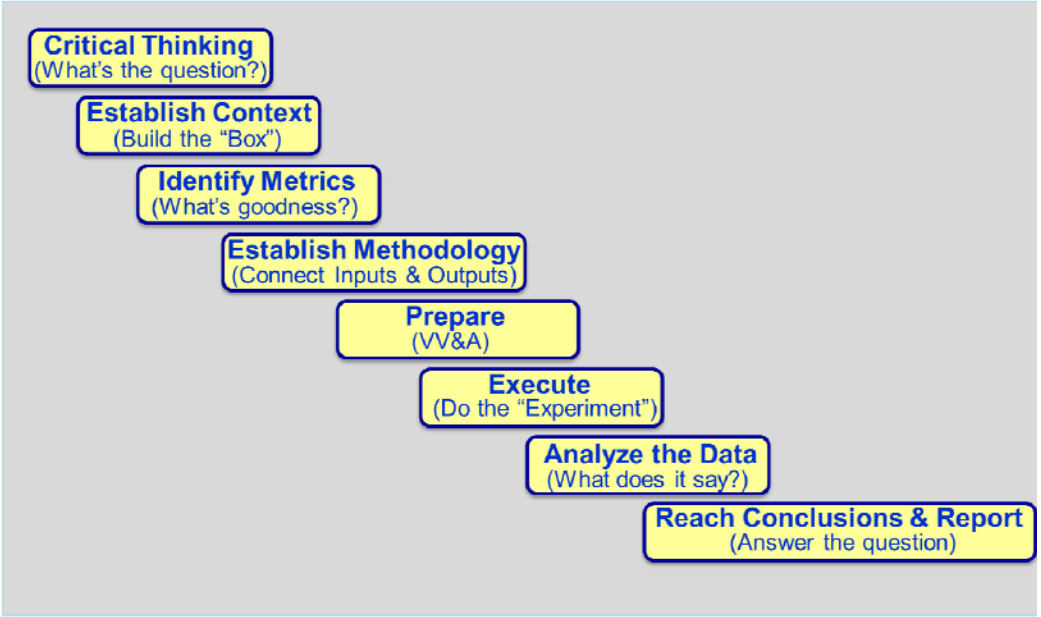
In March 2014, MORS conducted the workshop, ***"Affordability Analysis: Developing the Process,"*** the next step in serving the DoD Acquisition and Analysis Communities. Here MORS used rigorous and professionally-led methods to develop the underpinnings of a "How To" manual, or guidebook, for Affordability Analysis.

2014-2015

Using the foundation from the ***"Affordability Analysis: Developing a Process"*** workshop, the MORS CoP developed a process document titled *"BIG A" AFFORDABILITY ANALYSIS: Analytical Considerations for Conducting "Big A" Affordability Analysis*. Contributors included our Industry Marketing Partners (INCOSE, NDIA SE Division & ICEAA), the four Services, and others across government and industry.

Affordability Analysis – A Structured Process

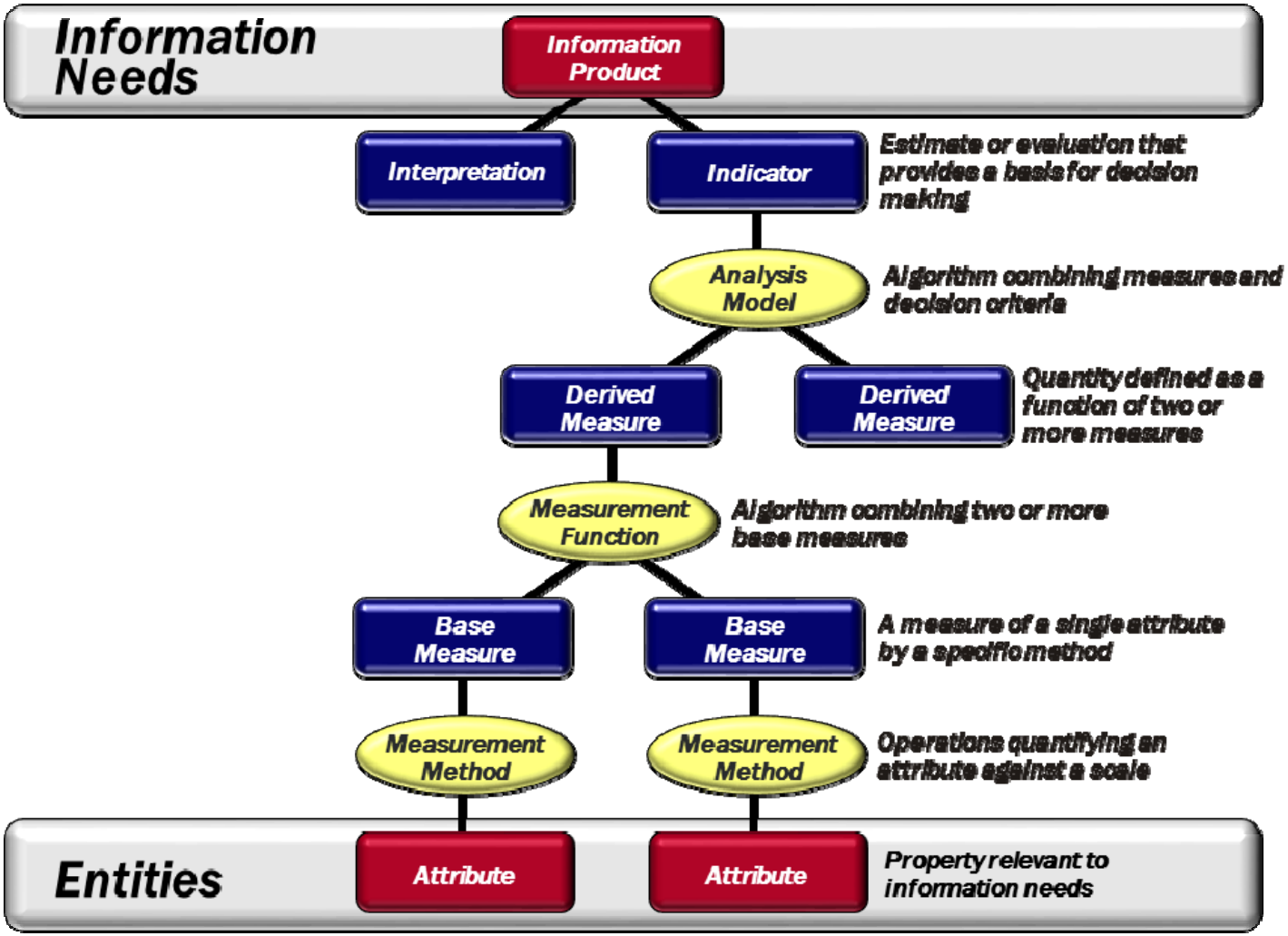
- **MORS Uses an 8-Step Process**
  - o Critical Thinking / Define the Problem (Step 1) understanding the Decision Maker is essential
  - o Final decisions are informed by:
    - Measurement data (Step 3 – ID Metrics)
    - Analysis (Step 6 & 7 – Execute and Analyze Data)
  - o The MORS AA CoP needs support from the measurement community developing the measurement plan



Organization / Community Involvement

- **From the beginning:**
  - o Government, Industry, Academia, FFRDCs, UARCs representatives
  - o Professional Societies: MORS, INCOSE, NDIA SE Division & ICEAA
- **Through initial collaboration with various communities**,
  - o Proven best practices and lessons learned were included in App D to also consider using when applying the "Big A" affordability analysis activities in Section 2.
  - o Operations analysis, cost analysis, economic analysis, system engineering, system architecture, program management, project management, etc.
- **Next Steps: Additional other communities**
  - o Measurement, Decision Analysis, Risk Analysis

Measurement Information Model



How Will the Goals Be Achieved?

- **Questions to be Discussed**: For each AA Activity
  - o What are the sources for measurement information needs?
  - o What are the measurement information needs?
  - o What is the prioritization for the measurement information needs?
  - o What is needed to be known for the measurement information needs?
  - o What are the relevant / common set of candidate measures?
  - o (Time permitting) Are there obvious categories that can be used to classify affordability analysis types of needs
- **Other Discussion**:
  - o Information about measurement usage
  - o Measurement strategies & drivers (i.e., sources of information needs)

After the affordability analysis activity overview, then the breakout session will start. The plan is to ask the above questions in each breakout session (10-15 minutes each).

What are the Expected Outputs?

- **Breakout Session Output**:
  - The answers to the questions will be collected which include:
    - Measurement information needs sources
    - Measurement information needs
    - Measurement information needs prioritization
    - Measurement information needs – what is needed to be known?
    - The relevant / common set of candidate measure
    - (Time permitting) Any obvious categories that can be used to classify affordability analysis types of needs
  - The captured discussion including
    - Information about usage, such as timing
    - Measurement strategy & drivers

Sources of Measurement Information Needs for the First 7 Priorities

- Real estate listings
- Personal finance
- Buyer needs and wants
- Builder/seller options
- Population demographics
- Police records
- Tax records
- Banking Home Mortgage Policies
- Buyer bank records
- Buyer spending habits
- City map
- Car
- Train station map
- Train
- School records

Identifying Measurement Information Needs

Classical PSM Sources

- Risk assessments
- Project constraints and assumptions
- Leveraged technologies
- Product acceptance criteria
- External requirements
- Experience on similar analyses

Classical PSM Info Need Categories

- Schedule and Risk
- Resources and Cost
- Size and Stability
- Product Quality
- Process Performance
- Technology Effectiveness
- Customer Satisfaction

Determining what makes sense for Affordability Analysis is probably a post WS task.

Leading to Affordability Analysis

2009

Congress passes the Weapon System Acquisition Reform Act ***(WSARA) to improve the way DoD contracts and purchases major weapons systems***. The law established the Office of Cost Assessment and Program Evaluation (CAPE) and emplaced reforms that were expected to save billions of dollars.

2010

As the WSARA formally demanded more fidelity and rigor in acquisition analysis, ***leaders in DoD asked MORS to engage the Acquisition and Analysis Communities to share and develop a set of best practices*** which address risk assessment and trade space analysis in support of acquisition.

2011

In Sept. 2011, MORS held the workshop ***"Risk, Trade Space & Analytics in Acquisition,"*** to determine and share a set of best practices for those significant analytic challenges that arise during the acquisition process. ***One significant conclusion from that workshop was that "affordability analysis" was poorly defined across the community.*** Leaders in DoD asked MORS for help with definitions and procedures.

MORS Affordability Analysis: Organizations

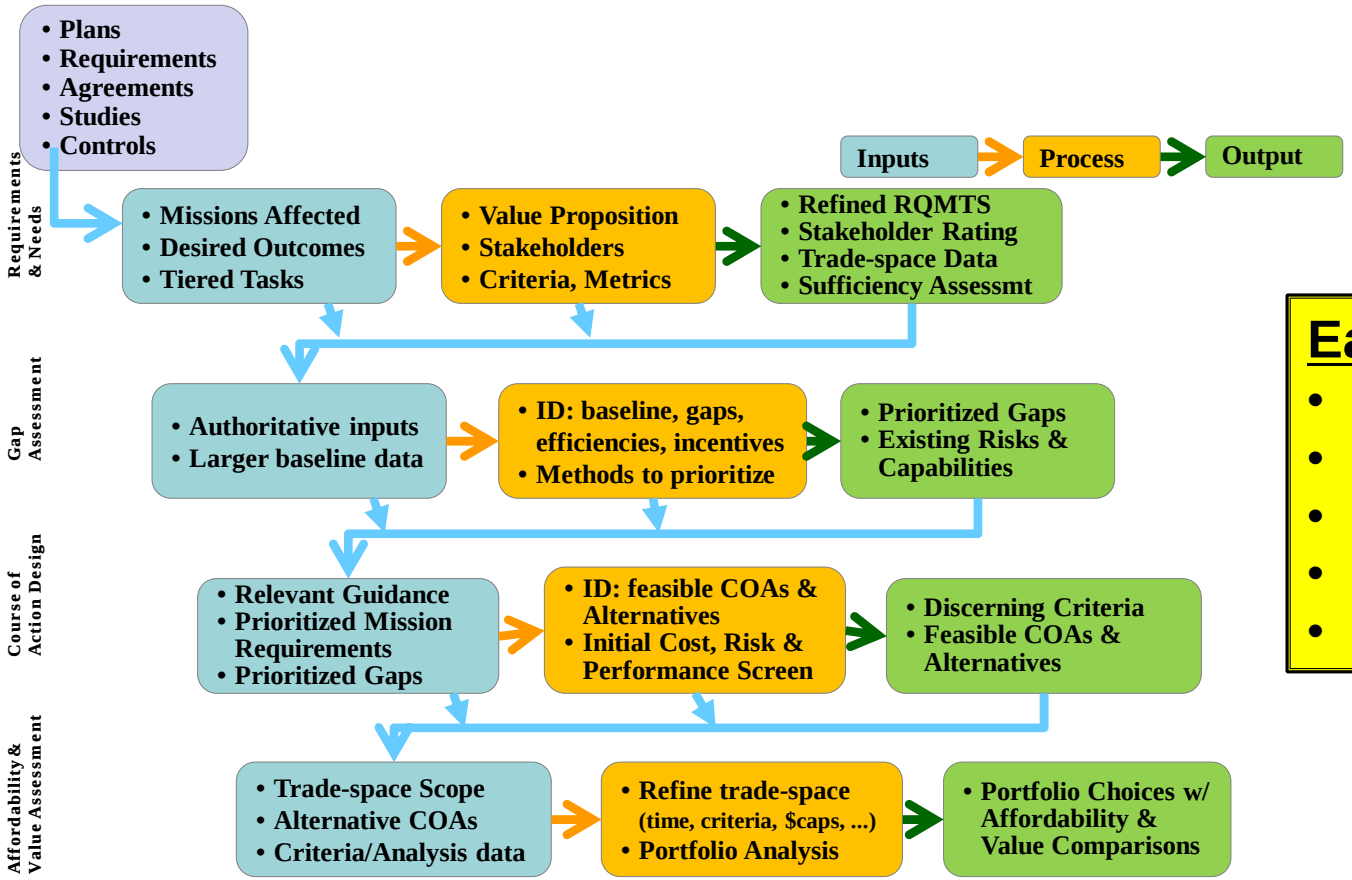
- **Proponents**
  - ASD(Acquisition), OSD(ATL) & J8
- **Industry Marketing Partners**
  - The International Council on Systems Engineering (INCOSE),
  - The National Defense Industrial Association Systems Engineering Division (NDIA SE), and
  - The International Cost Estimating and Analysis Association (ICEAA)
- **Leadership Team**
  - USAF AFMC HQ AFMC / A5CE
  - USA TRADOC Analysis Center
  - USMC HQMC P&R PA&E
- **Core Team**
  - MITRE, Price Systems & Lockheed Martin

MORS Affordability Analysis: Other Organizations

- **Other Government**
  - COCOMs: CENTCOM, EUCOM, NORTHCOM, PACOM & STRATCOM
  - International: UK MoD, Australia DSTO
  - NavAir, TRAC-WSMR, HQMC C4, USA Corps of Engineers
- **Industry**
  - Boeing, Northrop Grumman, Lockheed Martin
  - Accenture, Textron Systems, Technomics, Analytical Graphics, SAS
- **Other**
  - Academia: DAU & NPS
  - UARC: JHU/APL
  - FFRDC: MITRE

Affordability Analysis Process

An Overview: "Big A" Affordability Analysis

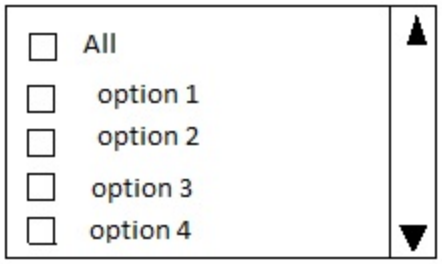


Each Activity:

- Overview
- Inputs
- Sub-Activities
- Exit Criteria
- Outputs

"Big A" Affordability Analysis Process: Completely Tailorable

- **All the information in the MORS "Big A" Affordability Analysis Process Guide is completely tailorable**
  - Don't have to repeat steps already completed for other tasks
  - Don't have to do tasks that the program believes are unnecessary
  - Documents contain best practices and lessons learned from many communities – all were included for your consideration



"Big A" Affordability Analysis Appendices #1

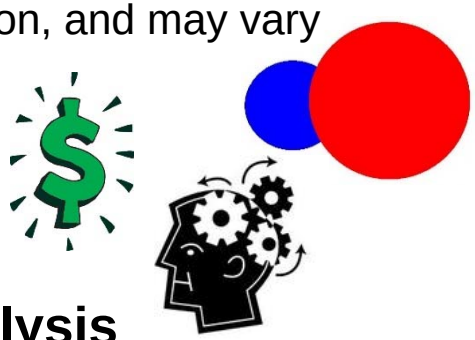
- **A – MORS Background**
  - MORS & Affordability Analysis
- **B – Checklists**
  - Each of the 4 AA Activities
- **C – Consideration When Starting**
  - Roles & Responsibilities (Oct '12 WG 1 Table)
  - Potential Metrics & Analysis (Oct '12 WG 3 Table)
  - Selected References & Tools
  - Sustainment Quad Chart
- **D – Other Community Best Practices & Lessons Learned**
  - Acquisition Life Cycle
  - Roles & Responsibilities
  - Initial Affordability Assessment
  - Opportunity Costs
  - Affordability Targets
  - Assumptions & Key Parameters
  - Architecturally Driven Analytics
  - Perishable Attribute, Agility
  - Risk & Measurement
  - Evolutionary Acquisition
  - Portfolio & Knowledge Mgmt

"Big A" Affordability Analysis Appendices #2

- **E – Other Considerations**
  - Decisions at Different Levels
  - Useful Affordability Analysis
  - Benefits, Sufficiency & Quality
  - Visualization
  - Risk & Uncertainty
- **F – References**
  - Acronyms
  - Glossary
  - Organizational Contributions
  - AA CoP Members
  - March 2014 Workshop Attendees
  - References
  - End Notes

Affordability Perception

- **October 2012 Consensus about Affordability Analysis**
  - Clarity of definition, sufficiency criteria, & regulatory policy were consistently absent
  - Affordability was determined not to be a number, but a decision, and may vary depending on the stakeholder or the decision maker
    - Size dimension: DoD, service, mission area, or system
    - Measurement dimension: Dollars, lives, or time
    - Phase dimension: Requirement, acquisition, or operation



- **October 2012 Cost Analysis vs. Affordability Analysis**
  - When cost analysis is conducted, the process is straightforward; analysts follow established guidelines and principles.
    - Not always the case, not all organizations have established process or certified cost estimators.
  - However, when conducting affordability analysis, approaches vary dramatically.
- **The initial thoughts from the October 2012 workshop**
  - Guidance, processes, and institutional acceptance are needed though tools and methodologies were not considered the binding constraints at the time; without them, there will be varying perspectives on what affordability is.

Oct 2012 Comparison: Cost & Affordability

- **Cost Analysis and Affordability Analysis are not the same**
- **Cost Analysis**
  - Cost analysis is a dollar breakdown across the acquisition life cycle, *tactical in nature* with extensive use of estimation tools.
- **Affordability Analysis**
  - Affordability analysis is *strategic in nature*. It looks at trade demands, dollars per capability, return on investment; and requires a behavioral change in culture

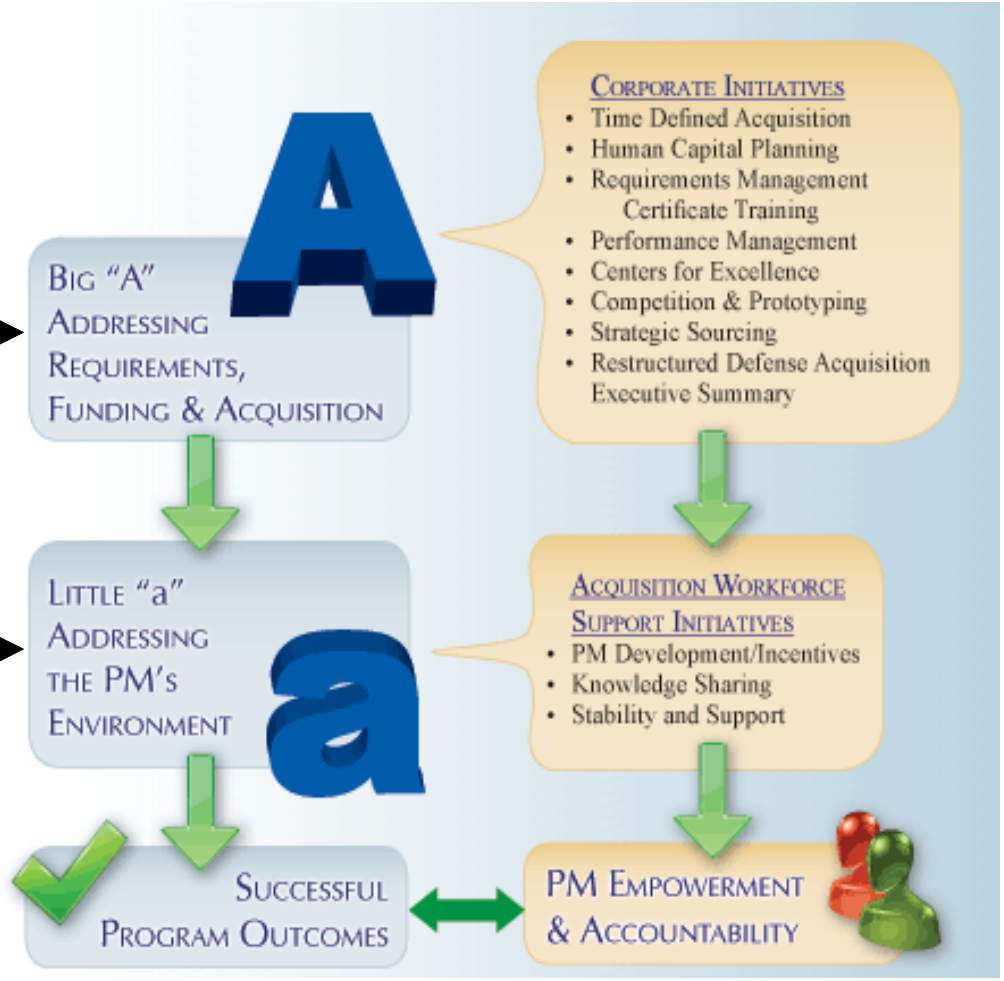
Affordability Interpretations

- **Affordability in the Large**
  - Assessing whether a mission, task, function, capability, system of systems, program, or initiative – considering what it is going to cost (or is costing us, i.e., the total costs) – provides sufficient value in the context of all of the other things needed ("**Big A**").
  - The Strategic View – Identifying the portfolio of solution(s) at the top level, considering life cycle cost and capability/performance in relation to the value provided by other things that are needed
- **Affordability in the Small**
  - Being frugal – being cost efficient in executing a program, from beginning to end and not being extravagant in choosing capabilities and solutions to challenges; getting the most bang for the buck ("**little a**").
  - The Tactical View – Minimizing costs while maximizing capabilities/performance.

"Big A" & "little a" Affordability

Doing the right things

Doing things right



"Big A" AFFORDABILITY ANALYSIS

- **"Big A"**
  - Do the right things
  - Strategic view
  - Identifying the portfolio of solution(s) at the top level, considering life cycle cost and capability/performance in relation to the value provided by other things that are needed

Affordability

- **Mechanics**
  - Plot cost and performance
  - Envelope the data
  - Overlay the constraints and criteria

"little a" Affordability Analysis

- "little a"
  - Do things right
  - Tactical view
  - Minimizing costs while maximizing capabilities/performance
- Mechanics
  - Look at delta cost <u>and</u> delta performance from the baseline
  - Score and sort the options based on slopes

affordability

"Big A" Affordability Decisions

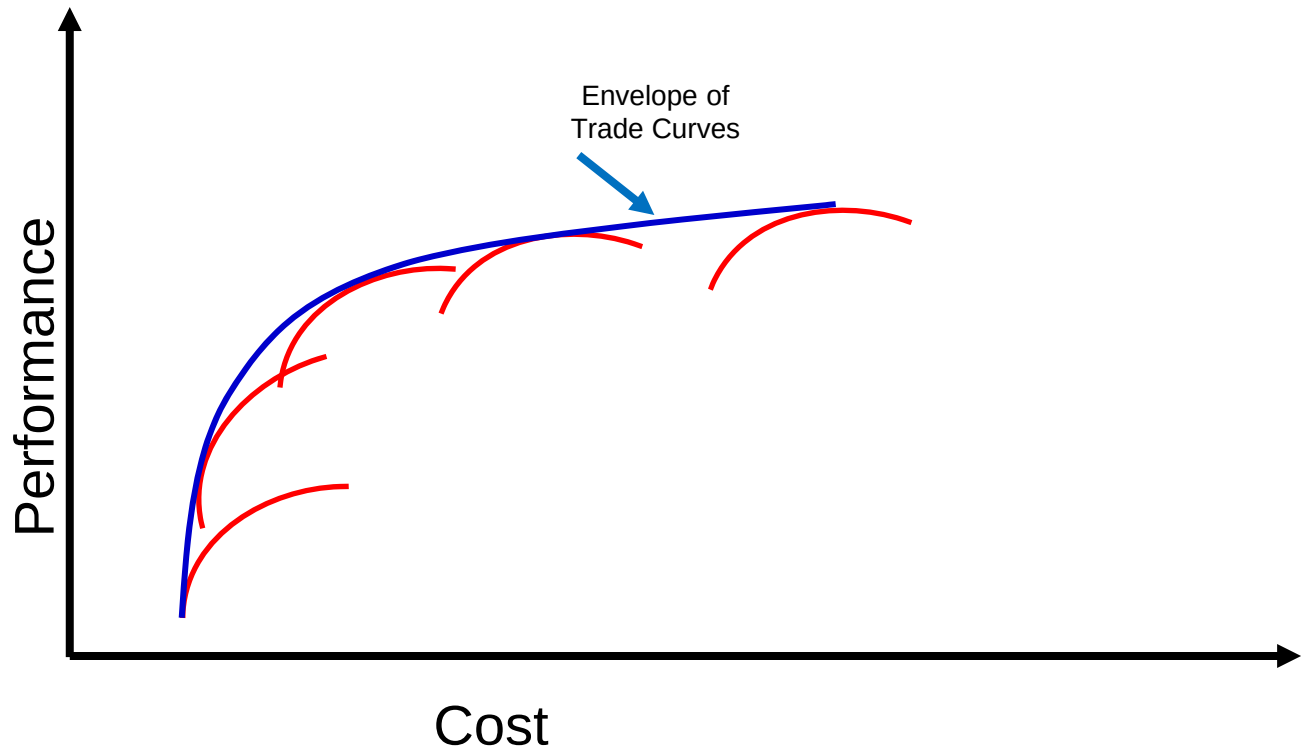
- **"Big A" and "little a" Affordability**
  - o New elements in a portfolio may be "Big A" affordable and break "little a" choices.
  - o Conversely, "little a" choices might locally seem like best but be "Big A" sub-optimal.
- **Overall "Big A" Affordability is using *good* judgement with the available data – as for all decisions.**
  - o "Big A" Affordability is now about using available data to make important decisions; it is *not* about "judgement calls" over data.
  - o Affordability (cost plus performance) *can* be measured, which will improve our ability to make high-quality, auditable, data-driven decisions.
  - o Reference architectures and taxonomies to identify cost and performance attributes can be leveraged productively.

Why Conduct "Big A" Affordability Analysis?

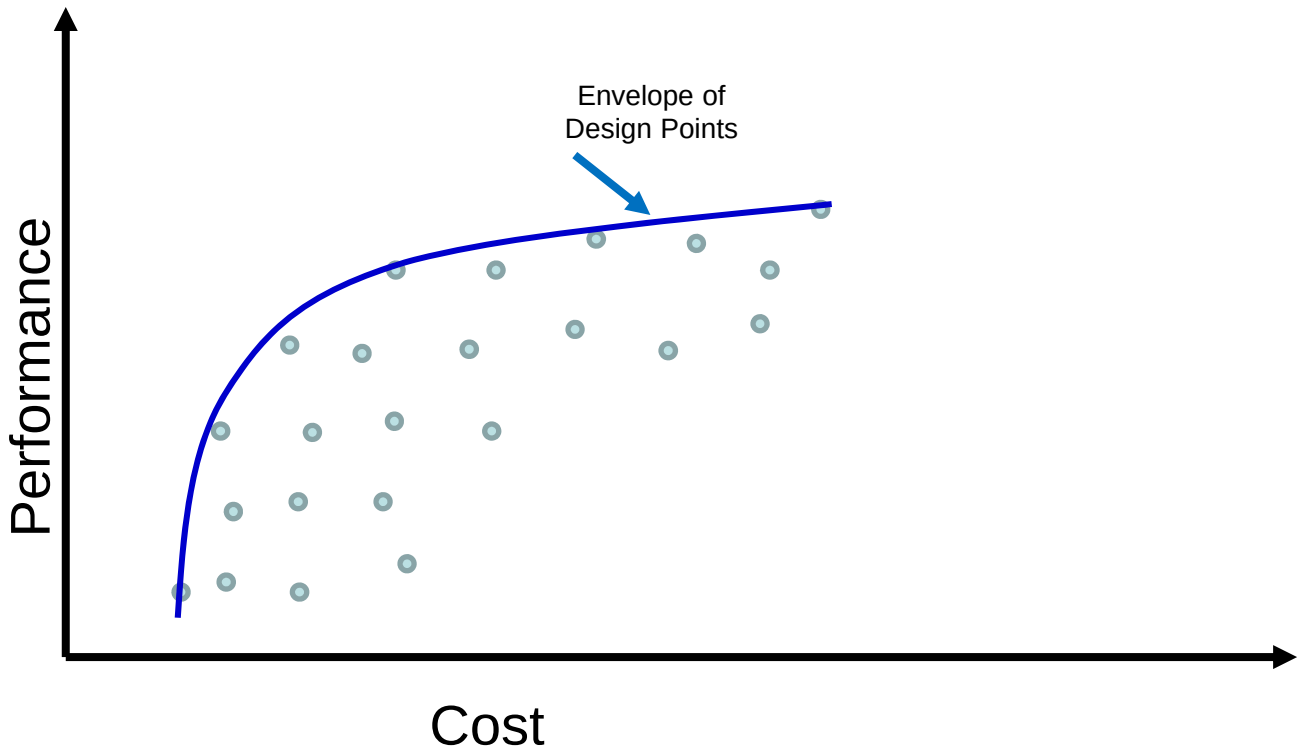
Why use the MORS Process Guide for "Big A?"

- "Big A" decisions can affect "little a" and vice versa,
- "Big A" Affordability (cost plus performance) *can be* measured.
- To be ready for the government's RFP, many organizations are already "ghosting" the government's work, and
- The belief is by incorporating the MORS "Big A" Process Guide activities with the organization's existing "little a" activities, overall it ***will make the organization's "little a" affordability analysis stronger – and their "little a" activities should make their "Big A" analysis stronger, too.***

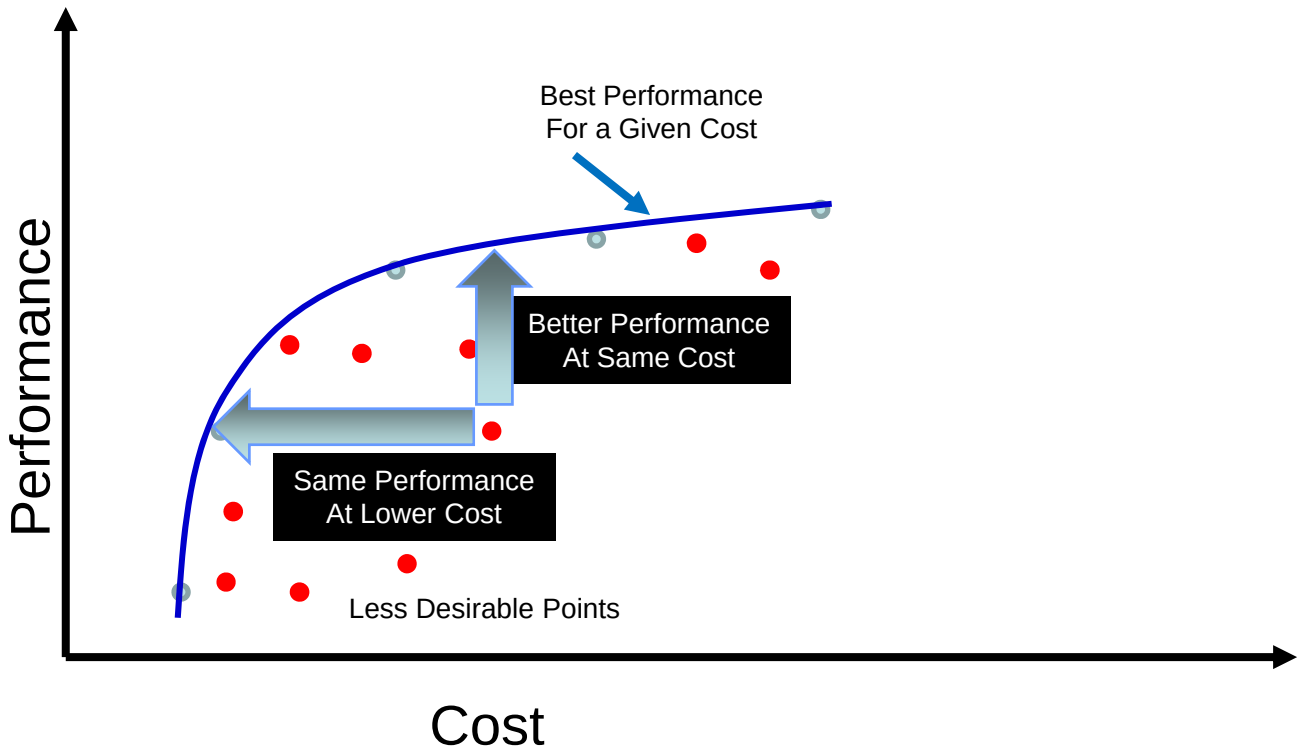
"Big A" Affordability: Performance versus Cost Envelope of Trade Curves



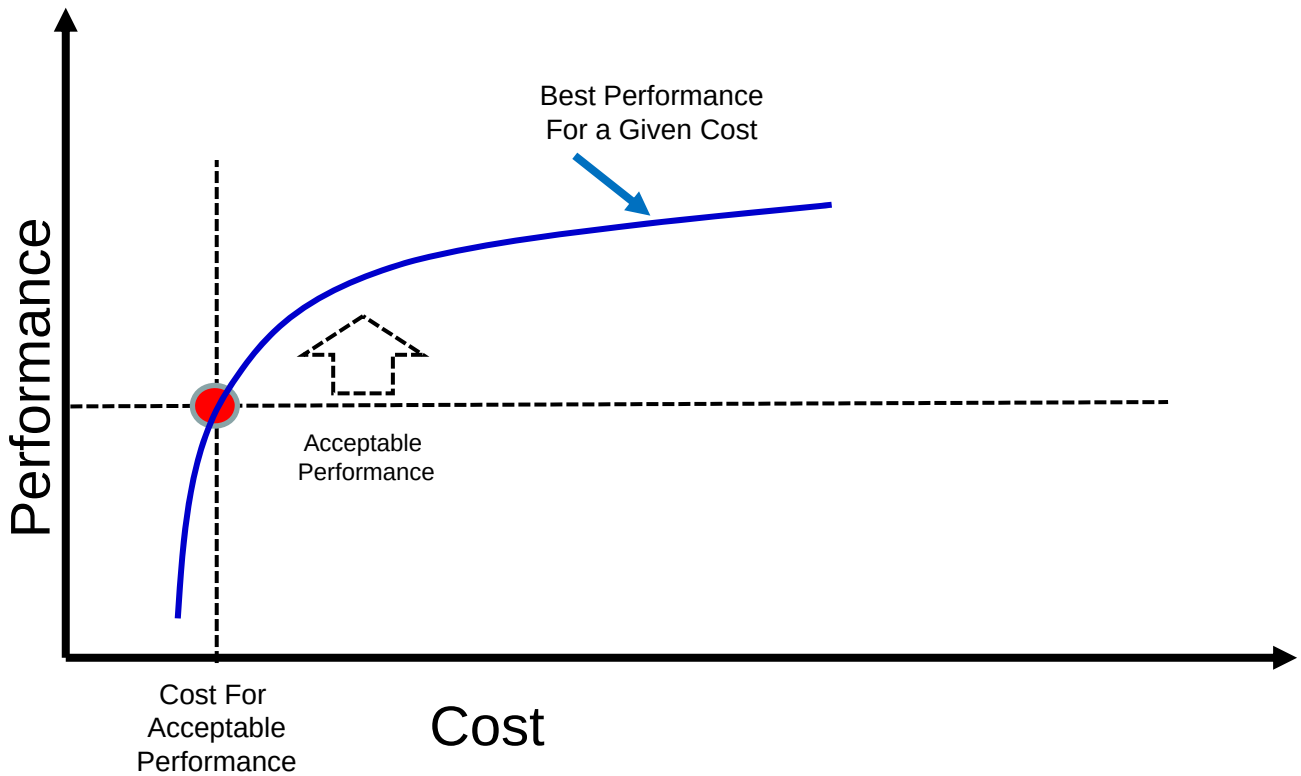
"Big A" Affordability: Performance versus Cost Envelope of Design Points



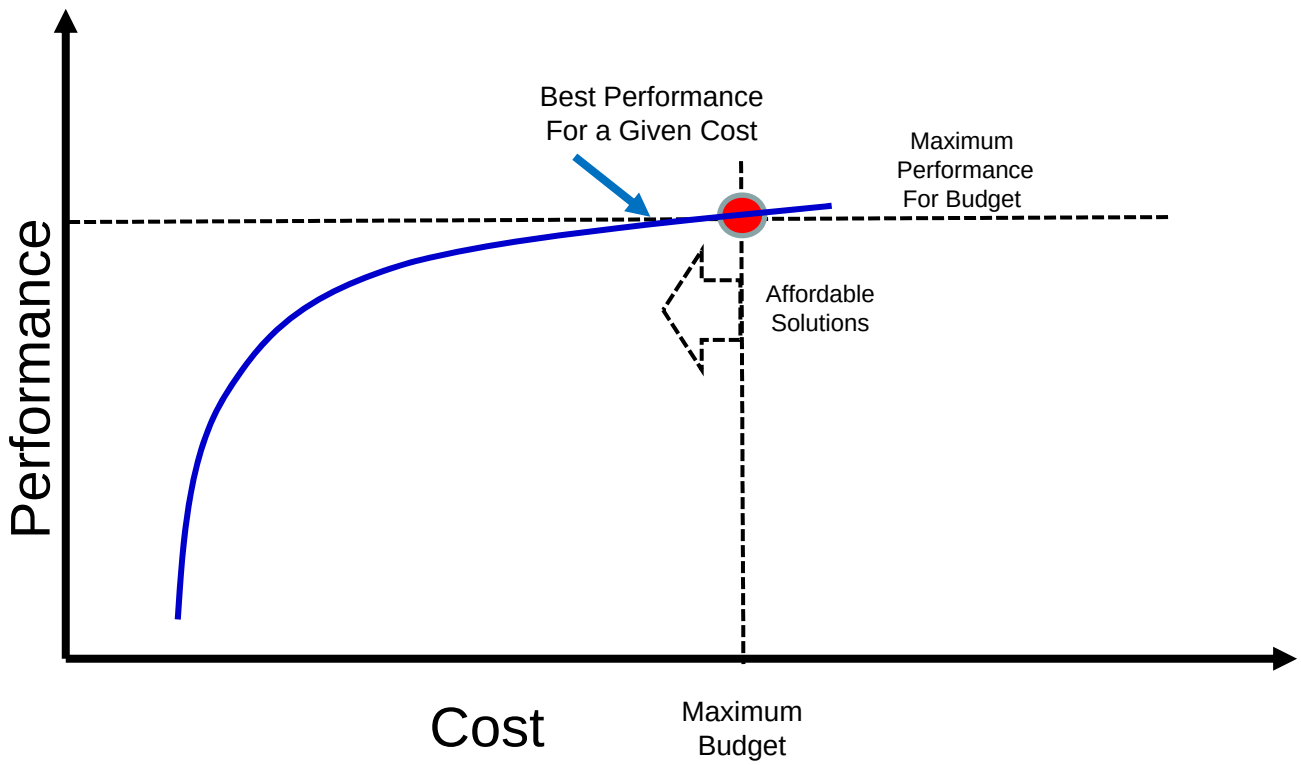
"Big A" Affordability: Best Performance for a Given Cost



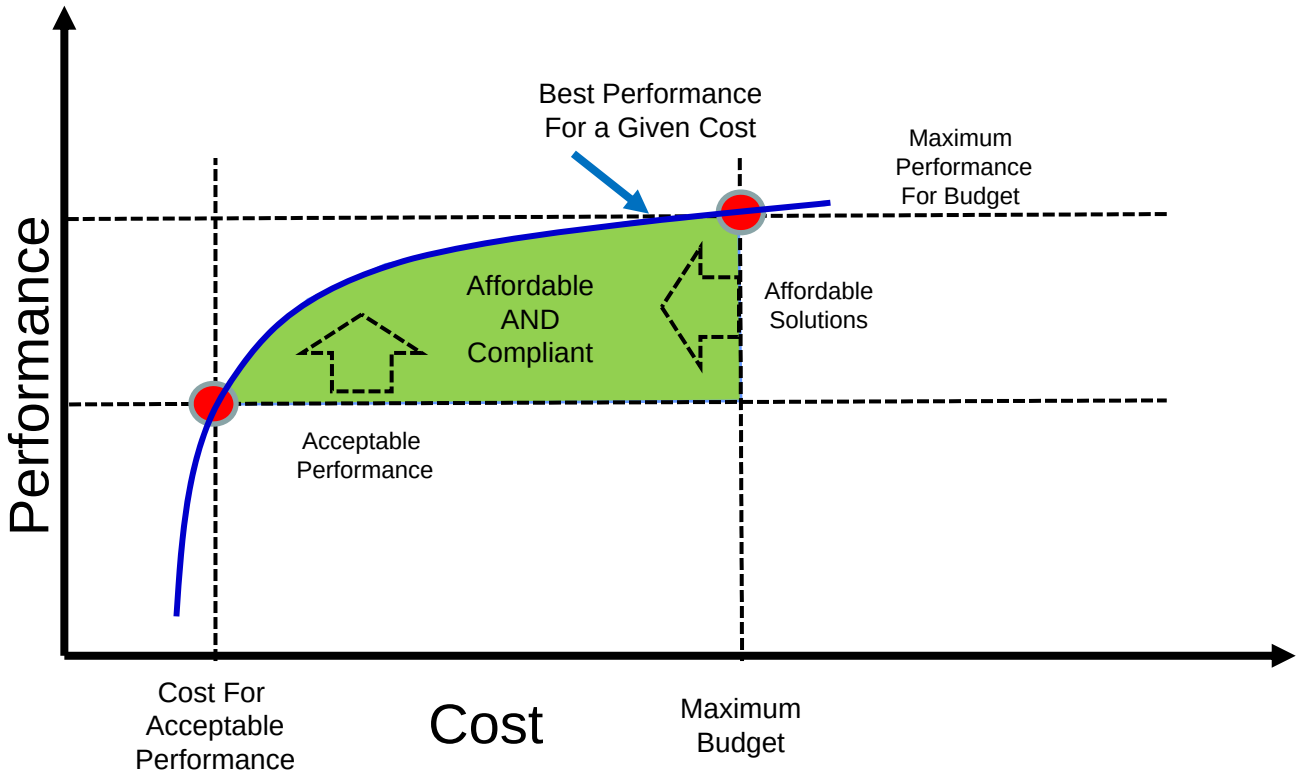
"Big A" Affordability: What's the Least I can Pay to Get What I Need?



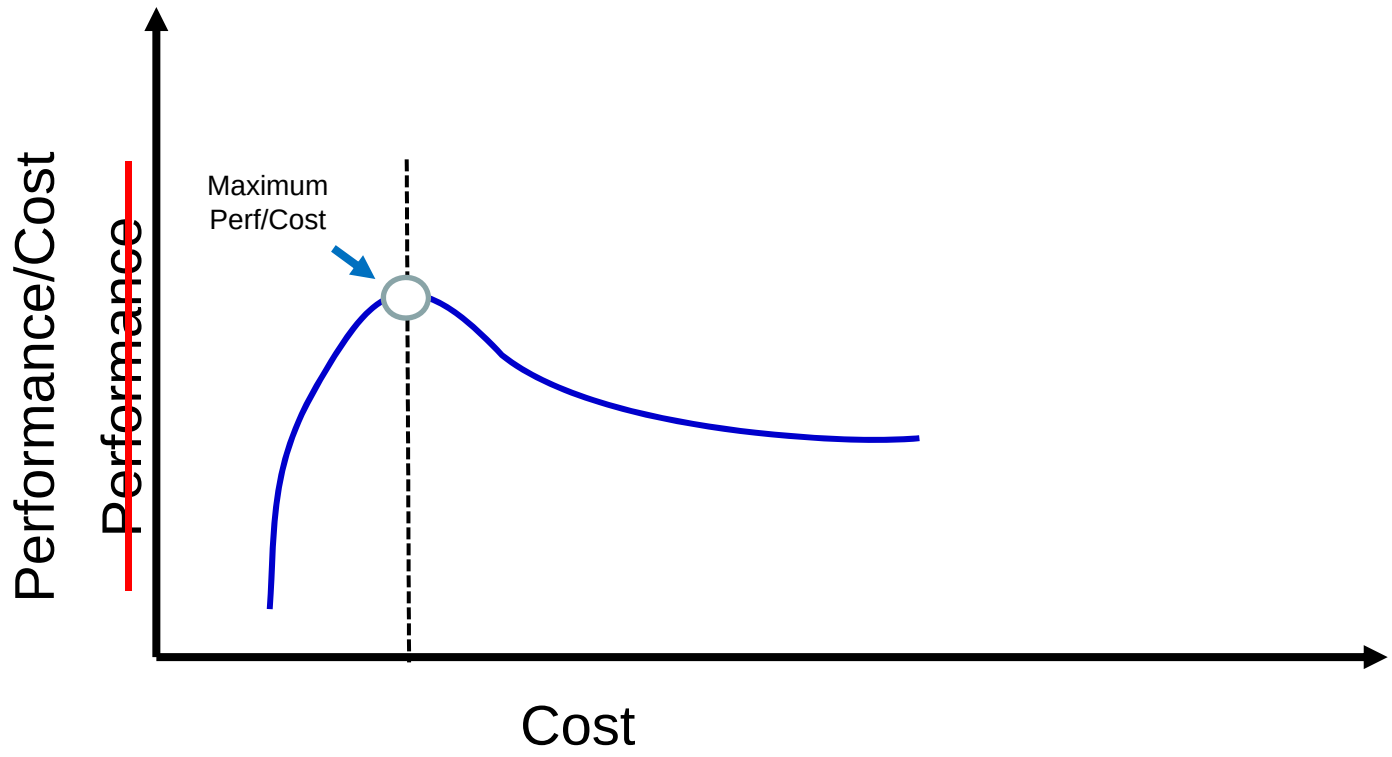
"Big A" Affordability: What's the Most I can Get for my Budget?



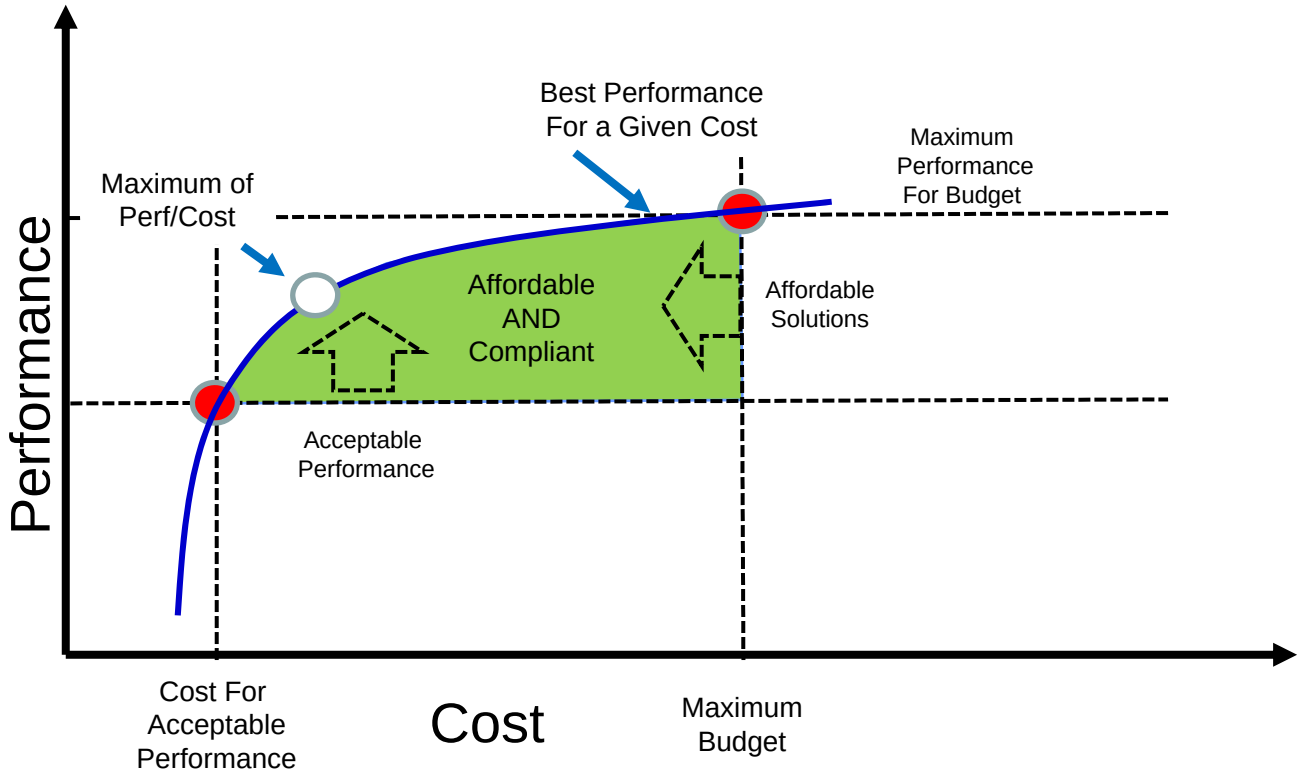
"Big A" Affordability: Affordable AND Compliant



"Big A" Affordability: What's the Best Performance for My Money?



"Big A" Affordability: Best Performance/Cost



"Big A" AFFORDABILITY ANALYSIS

- **"Big A"**
  - Do the right things
  - Strategic view
  - Identifying the portfolio of solution(s) at the top level, considering life cycle cost and capability/performance in relation to the value provided by other things that are needed

Affordability

- **Mechanics**
  - Plot cost and performance
  - Envelope the data
  - Overlay the constraints and criteria

"little a" Affordability Analysis

- What if we already have a baseline system?
  - Post-production
  - Modifications and upgrades
  - Cost improvements
  - Performance improvements
- Look at the deltas
  - Delta cost
  - Delta performance
- But these compete – how do we decide?

"little a" Affordability: Which of these options is best?

Option	Delta Cost	Delta Performance
A	5	10
B	-15	-5
C	-7	5
D	6	-5
E	10	15

"little a" Affordability: Cost Perspective: Sort by Delta Cost

Option	Delta Cost	Delta Performance
B	-15	-5
C	-7	5
A	5	10
D	6	-5
E	10	15

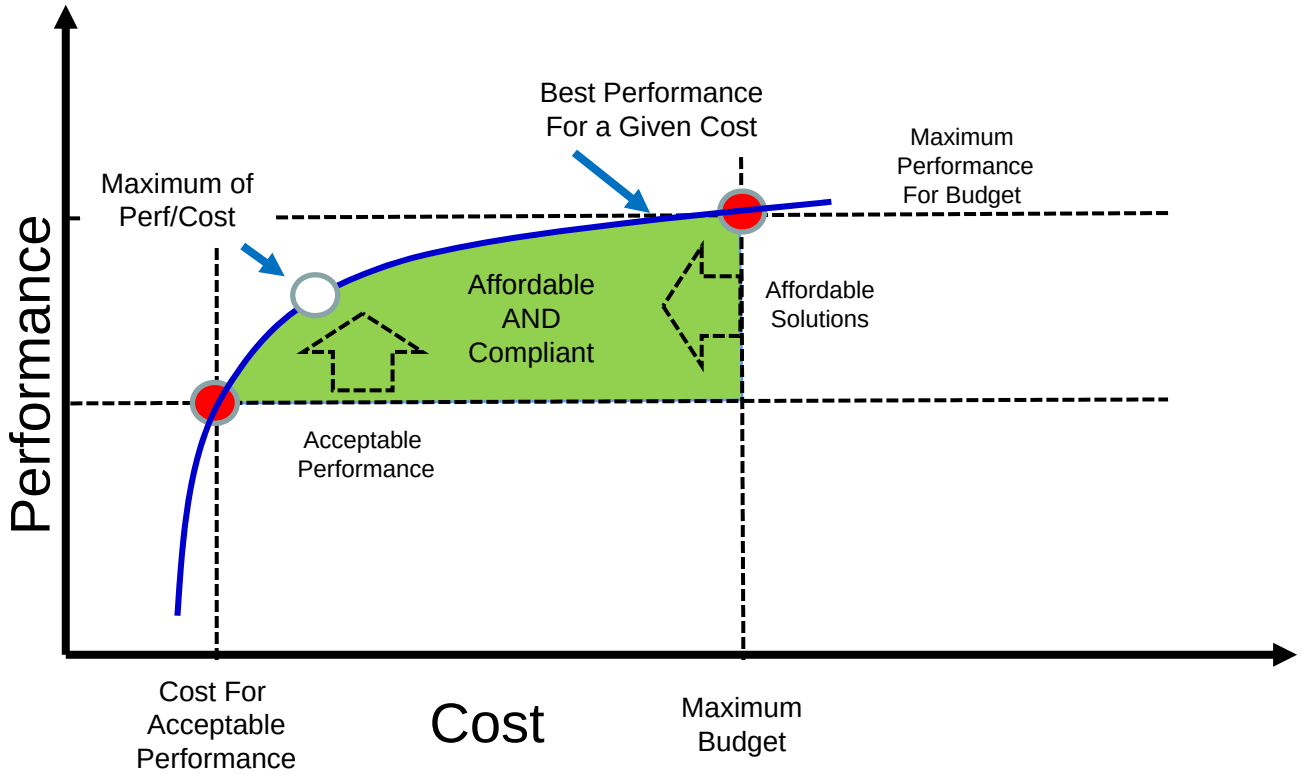
Option B is Best
… but hurts performance

"little a" Affordability: Performance Perspective: Sort by Delta Performance

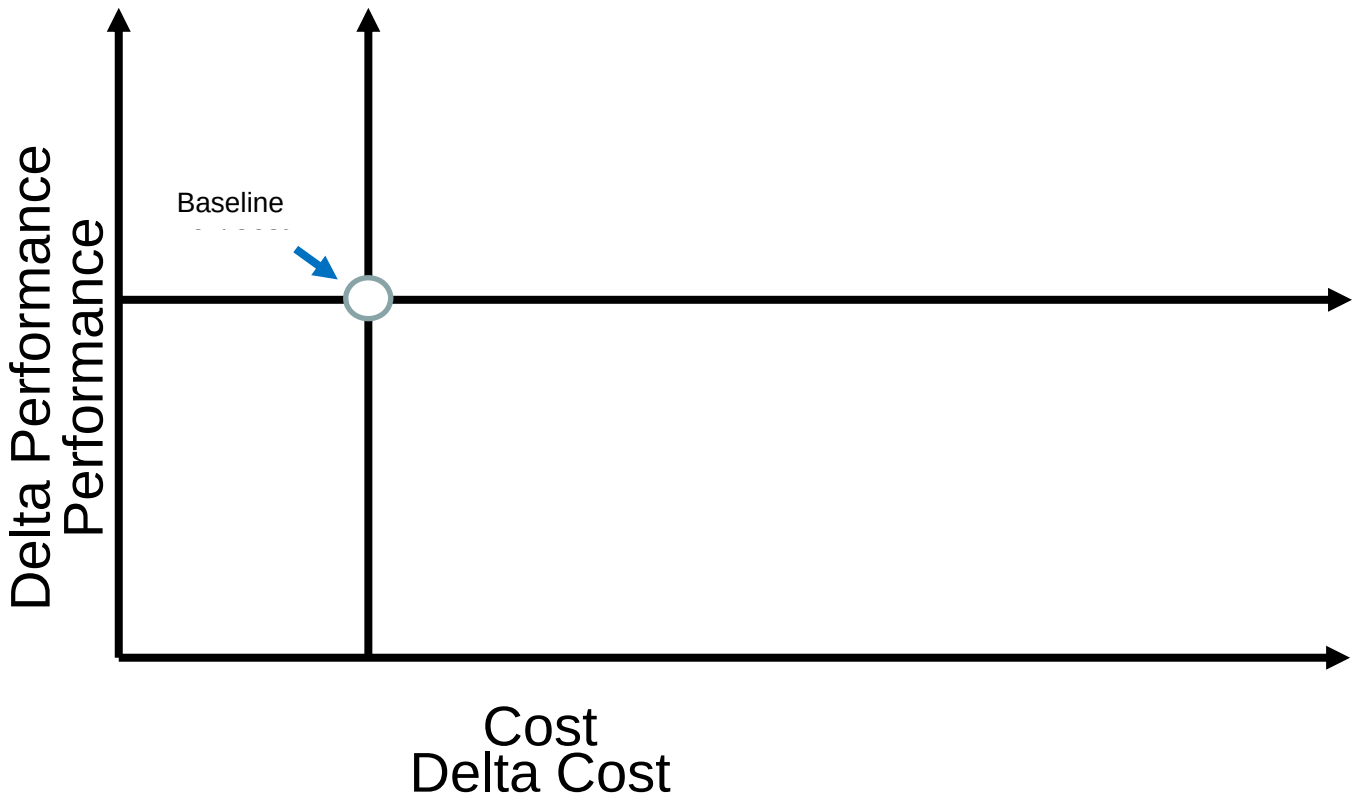
Option	Delta Cost	Delta Performance
E	10	15
A	5	10
C	-7	5
B	-15	-5
D	6	-5

Option E is Best
… but hurts cost

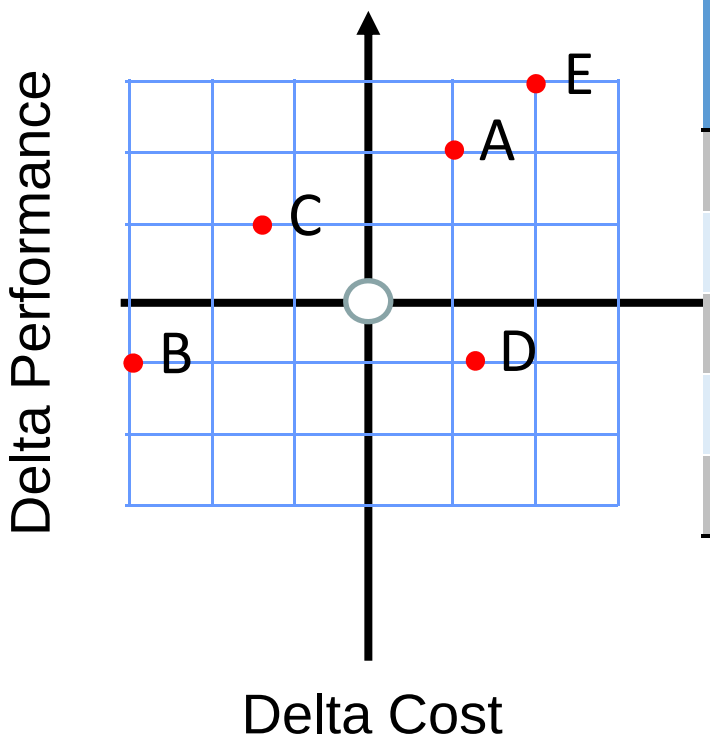
"little a" Affordability: Best Performance/Cost



"little a" Affordability: Baseline Delta Performance/Cost

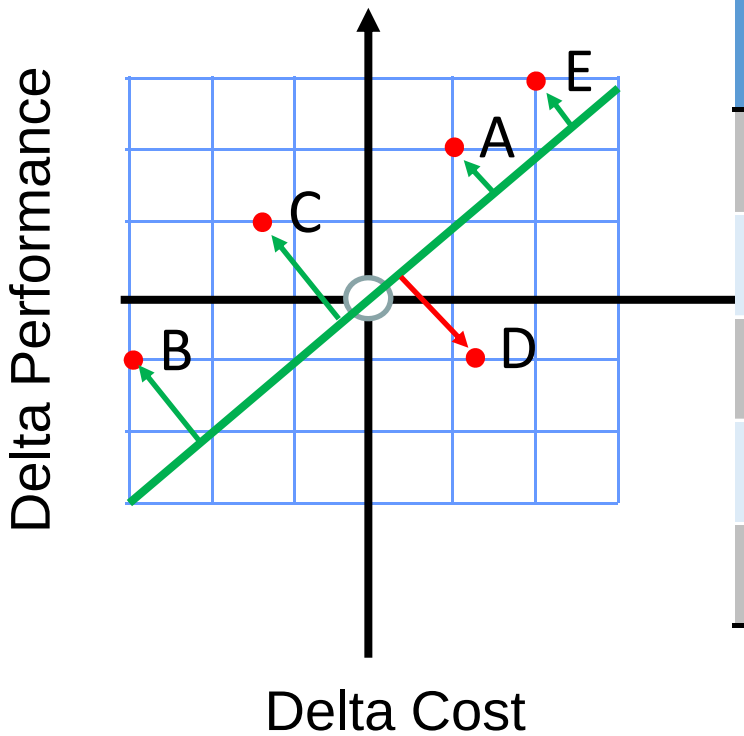


"little a" Affordability: Baseline Delta Performance/Cost



Option	Delta Cost	Delta Performance
A	5	10
B	-15	-5
C	-7	5
D	6	-5
E	10	15

"little a" Affordability: Affordability Perspective: Sort by Distance to Line



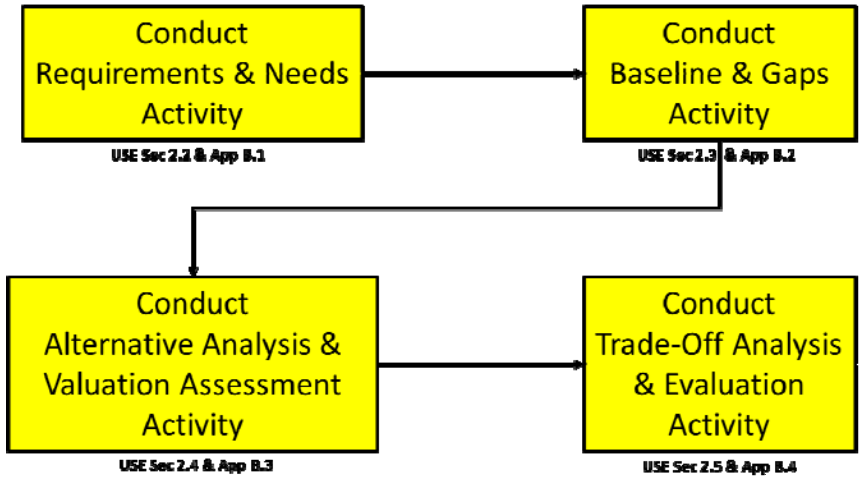
Option	Delta Cost	Delta Perf	Delta Afford
C	-7	5	12
B	-15	-5	10
A	5	10	5
E	10	15	5
D	6	-5	-11

Option C is Best Value

"little a" Affordability Analysis

- "little a"
  - Do things right
  - Tactical view
  - Minimizing costs while maximizing capabilities/performance
- Mechanics
  - Look at delta cost <u>and</u> delta performance from the baseline
  - Score and sort the options based on slopes

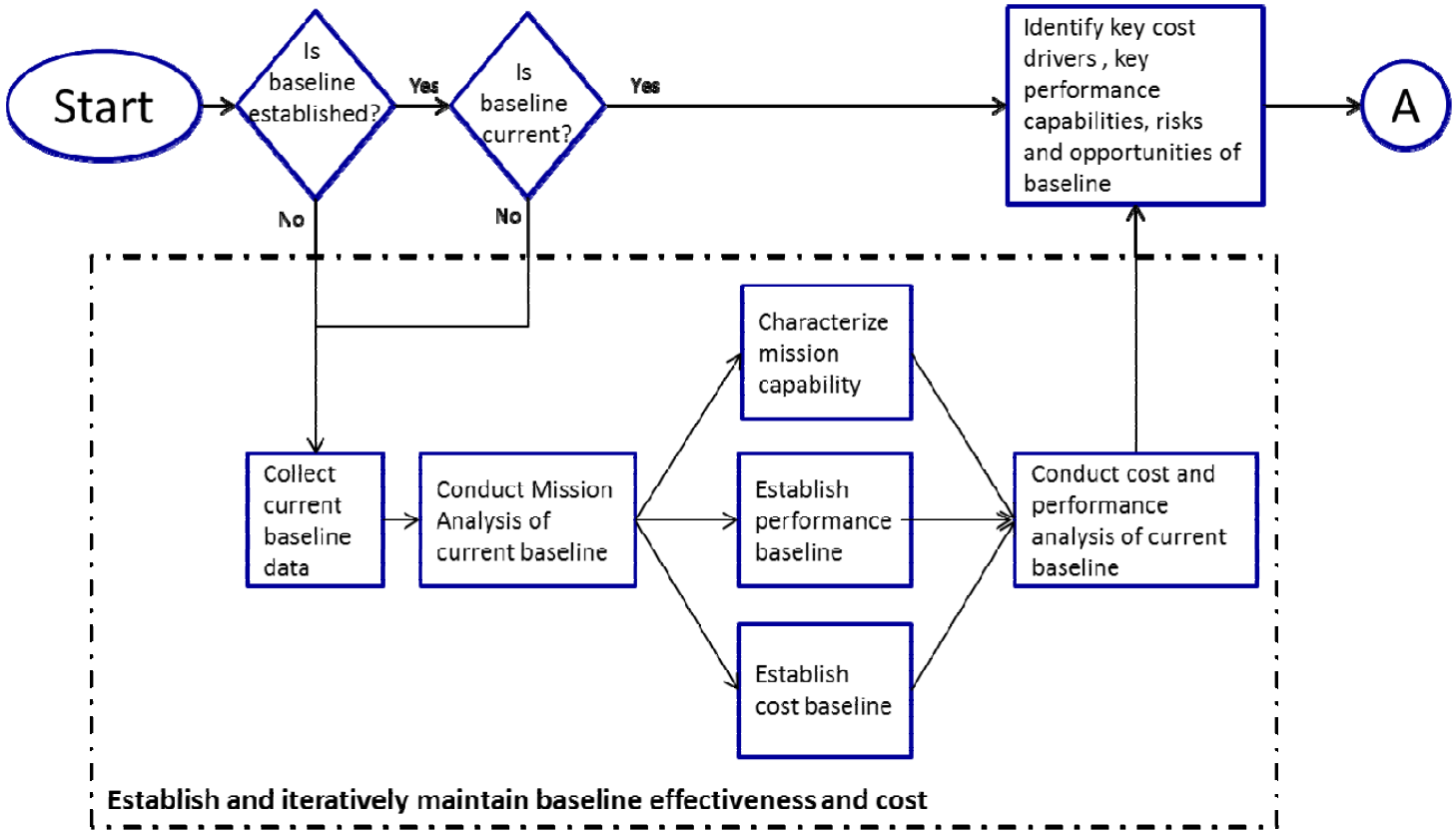
affordability



- **Each Activity has 5 "key" steps**:
  - o Overview / Value Stream Maps
  - o Inputs
  - o Sub-Activities with Tasks
  - o Exit Criteria (Sufficiency & Quality)
  - o Outputs

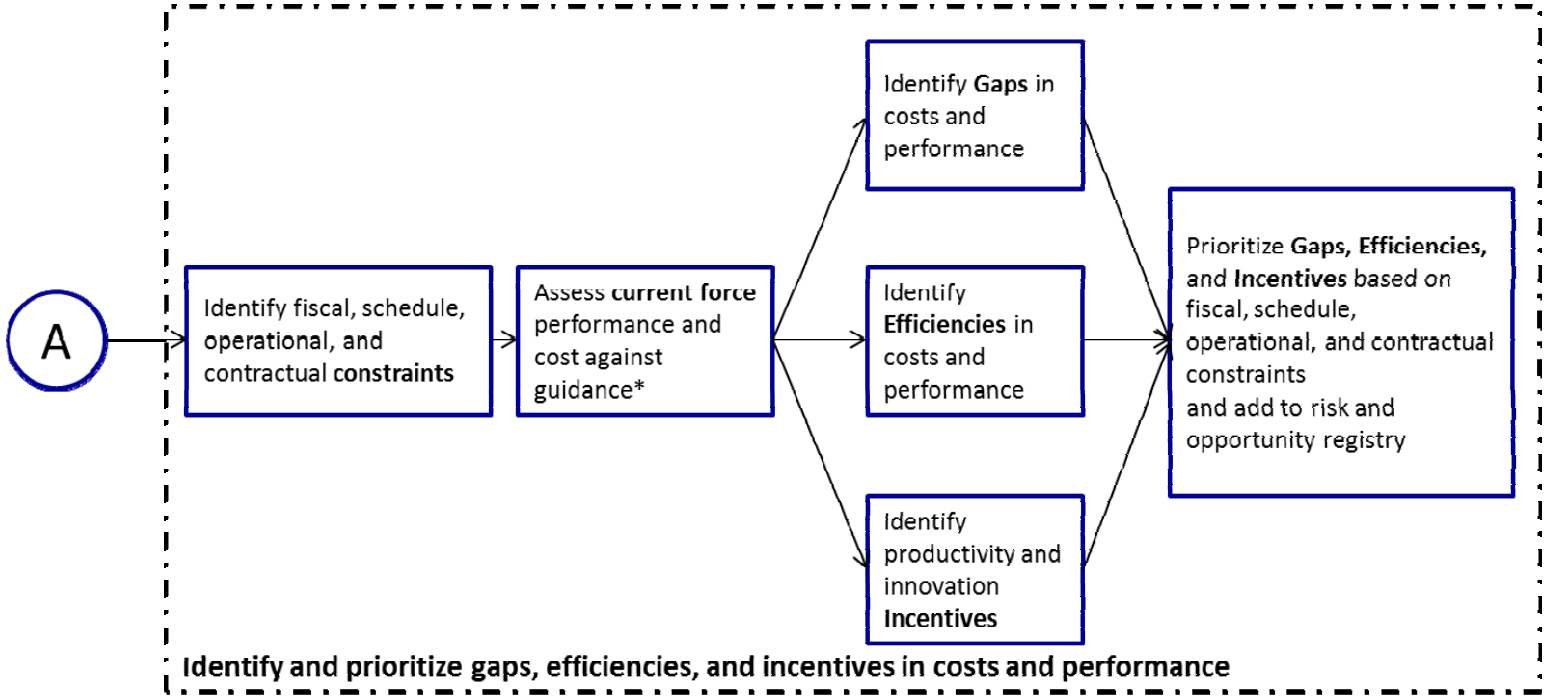
Value Stream Map Example

AA Activity # 2: Baseline Assessment



Value Stream Map Example

AA Activity # 2: Gap Assessment



**budget documentation, force long range strategic plan, National security strategy, etc.*

Checklist Examples

AA Activity # 2: Baseline & Gap Assessments

B.2.2.1 Baseline Assessment Sub-Activity

This sub-activity is not a trivial task, but is vital to the successful outcome of this overall activity. Establishing the baseline provides a starting point for the analysis, a measuring stick to begin the affordability analysis process. The intent is to assess current baseline capability performance. The recommended steps to consider for the process for this activity / sub-activity include:

_____ Step 1: Assess baseline status: is it established, and if so, is it current? If yes, go to step 3. If no, continue with step 2.

_____ Step 2: Establish and iteratively maintain baseline effectiveness and cost

- _____ Collect current baseline data
- _____ Conduct mission analysis of current baseline
- _____ Characterize mission capability, establish performance baseline & establish cost baseline
- _____ Conduct cost and performance analysis of current baseline

_____ Step 3: Identify key cost drivers, key performance capabilities, risks and opportunities of the baseline

MORS Process Guide
Baseline Assessment Checklist

MORS Process Guide
Gap Assessment Checklist

B.2.2.2 Gap Assessment Sub-Activity

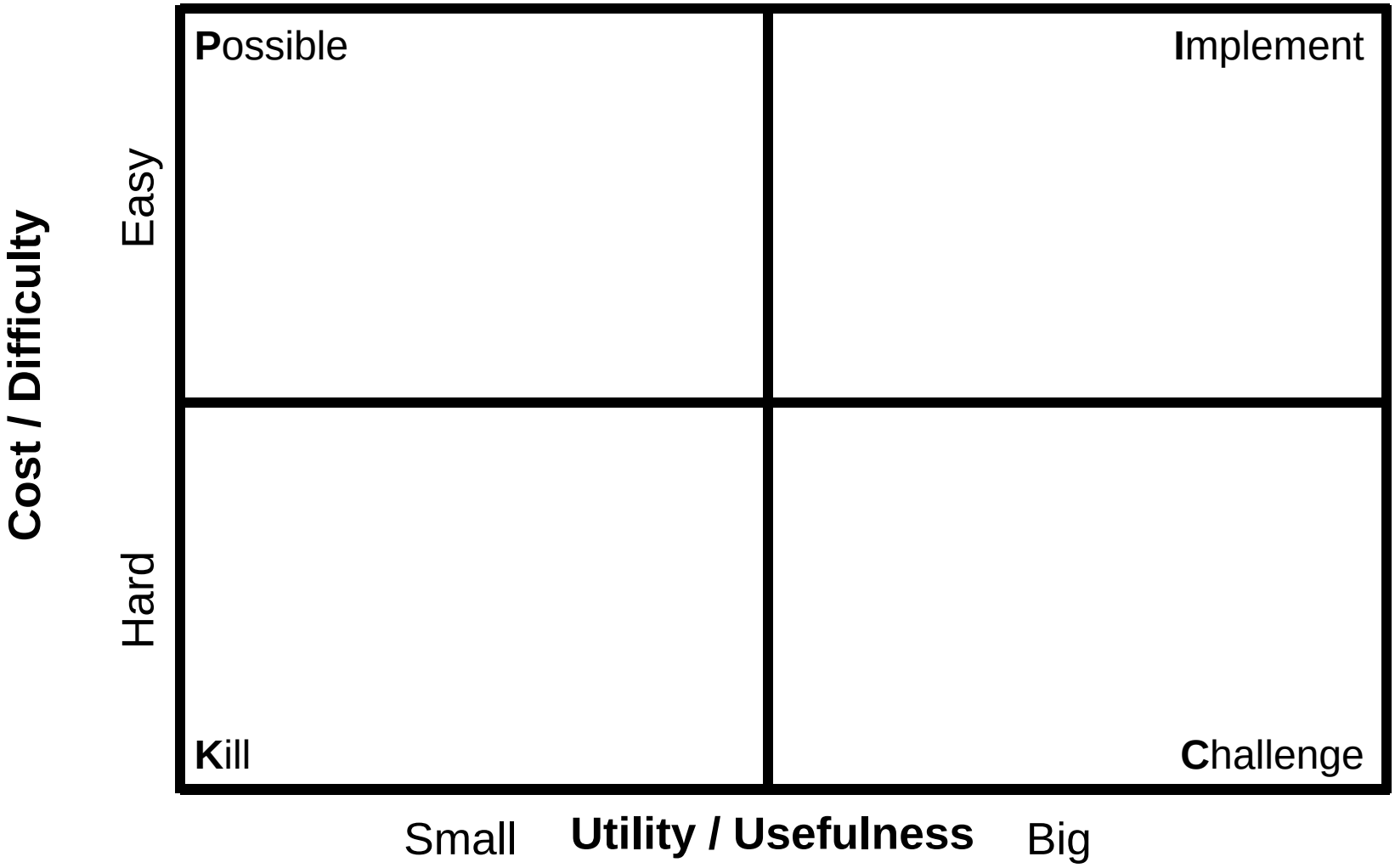
This task evaluates the baseline force performance and cost against future capability needs or force goals and enumerates gaps or shortfalls in performance or cost / affordability. This task also may highlight areas of efficiency or opportunity to improve performance or cost. Finally, with an understanding of gaps and efficiencies, incentives may be used to improve capability performance or costs. The intent is to assess gaps, efficiencies and incentives in the baseline capability performance. The identified and prioritized gaps, efficiencies and incentives set the stage for potential improvements. Given gaps, efficiencies and incentives, these need to be prioritized to emphasize which are most important to address or implement. The recommended steps to consider for the process for this activity / sub-activity include:

(1) _____ Identify and prioritize gaps, efficiencies, and incentives in costs and performance

a. _____ Identify fiscal, schedule, operational, and contractual constraints

b. _____ Assess current force performance and cost against guidance

- _____ Identify Gaps in costs and performance
- _____ Identify Efficiencies in costs and performance
- _____ Identify productivity and innovation **Incentives**

c. _____ Prioritize **Gaps, Efficiencies,** and **Incentives** based on fiscal, schedule, operational, and contractual constraints and add to risk and opportunity registry

Prioritizing Needs: PICK Chart